RegFlo™ RF100 Series Pressure and Flow Instruments

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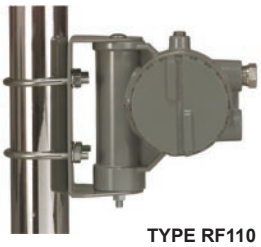

W8196

TYPE RF110 PRESSURE INSTRUMENT

W8162

TYPE RF100 FLOW AND PRESSURE INSTRUMENT MOUNTED ON A TYPE EZR REGULATOR

W8379

TYPE RF100 FLOW AND PRESSURE INSTRUMENT MOUNTED ON A TYPE 1098-EGR REGULATOR

Figure 1. *RF100 Series Pressure and Flow Instruments*

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D102767X012

US Patent Number 6441744
Other US and Foreign Patents Pending

www.FISHERregulators.com

Specifications

Available Configurations
- Type RF100 Flow and Pressure Instrument
- Type RF110 Pressure Instrument

Security
15 users with passwords and 3 levels of access

Alarms
- Hi, Hi/Hi, Low, and Low/Low on all analog inputs
- Logic alarms
- 240 logs in alarm log

Sensor and Pressure Ranges[1]
See table 1

Instantaneous Flow Estimation Accuracy
See tables 2 and 3 and the Instantaneous Flow Estimation Accuracy section.

Travel Sensor Accuracy
± 1 % of span

Log Interval

LOG INTERVAL, MINUTES	STANDARD HISTORY CAPACITY, DAYS (840 LOGS STORED, ALL VERSIONS)	EXTENDED HISTORY CAPACITY, DAYS (8640 LOGS STORED, AVAILABLE ONLY FOR FIRMWARE VERSION 2.xx)
1	0.6	6
2	1.2	12
3	1.8	18
4	2.3	24
5	2.9	30
6	3.5	36
10	5.8	60
12	7.0	72
15	8.8	90
20	11.7	120
30	17.5	180
60	35.0	360

Daily Log
35 days of daily values (average, accumulated, minimum and maximum)

Sample Intervals
1, 10, and 30 seconds; 1, 2, 5, 10, and 30 minutes

Power
Battery Input: 3.6 Vdc; **Input Power:** 10 to 28 Vdc

Battery Information
Lithium Ion, 3.6 Vdc, 19.0 amp-hours

Diagnostics
Board Temperature, Power Input, Logic/Battery Voltage

Processor Memory
Flash: 128 Kbytes
EEProm: 32 Kbytes
Static RAM: 128 Kbytes

Real Time Clock
- Hr : Min : Sec
- Day : Month : Year
- Battery Backed

Communication Ports
Operator Interface: RS-232 (RX, TX, RTS); ROC protocol only
COM1: RS-485; ROC and Modbus protocol
COM2 (Optional): RS-232 or V-22 BIS Modem; ROC and Modbus protocol

Environmental[1]
Operating Temperature: -40° to 167°F (-40° to 75°C)
Storage Temperature: -58° to 185°F (-50° to 85°C)
Operating Humidity: 5% to 95% non-condensing
Vibration: Meets SAMA PMC 31.1
Electromagnetic Interference: Designed to meet requirements of IEC 61326 Electrical Equipment for Measurement, Control, and Laboratory Use
Radiated Emissions: FCC Part 15 Class A

Approvals
CSA Class I, Division 1, Explosion-Proof, Gas Groups C and D; Class I, Division 2, Nonincendive groups C and D; Certified to Canadian and U.S. Standards

Connections
Electrical: Housing has 2 1/2-inch 14 NPT conduit connections for wiring
Process: Sensors have 1/4-inch 18 NPT process connections
Vents: Vent connections are tapped with 1/4-inch 18 NPT threads for use with piping in pit installations

1. The pressure/temperature limits in this manual and any applicable standard or code limitation should not be exceeded.

Table 1. *Sensor and Pressure Ratings, and Accuracy*

SENSOR RANGE, PSIG (bar)	ACCURACY, % OF SPAN		MAXIMUM OPERATING PRESSURE, PSIG (bar)	MAXIMUM EMERGENCY PRESSURE, PSIG (bar)
	-4° to 122°F (-20° to 50°C)	-40° to 167°F (-40° to 75°C)		
0 to 30-inches w.c. (0 to 75 mbar)	1.5	2.5	9 (0,62)	300 (20,7)
0 to 15 (0 to 1,03)	0.5	1.0	45 (3,10)	475 (32,8)
0 to 35 (0 to 2,41)	0.5	1.0	85 (5,86)	475 (32,8)
0 to 100 (0 to 6,90)	0.5	1.0	185 (12,8)	475 (32,8)
0 to 300 (0 to 20,7)	0.5	1.0	585 (40,3)	1500 (103)
0 to 500 (0 to 34,5)	0.5	1.0	985 (67,9)	1500 (103)
0 to 1000 (0 to 68,9)	0.5	1.0	1500 (103)	1500 (103)
0 to 1500 (0 to 103)	0.5	1.0	1500 (103)	1500 (103)

I/O Board Specifications (optional)

Available Channels

1 - Dedicated Analog Input (AI)
2 - Selectable Analog Input (AI) or Output (AO)
3 - Dedicated Discrete Input (DI)
4 - Selectable Discrete Input (DI) or Output (DO)
5 - Dedicated Discrete Output (DO)

Configurations (Selectable)

- 1-AO, 1-AI, 2-DI, 1-DO
- 1-AO, 1-AI, 1-DI, 2-DO
- 2-AI, 2-DI, 1-DO
- 2-AI, 1-DI, 2-DO

Classification

FCC Class A and CISPR 22 computing device

Analog Input

Quality/Type: Single-ended, voltage-sense analog inputs (current loop if scaling resistor is used).
Signal: 1 to 5 Vdc, software configurable.
4 to 20 mA, with 250W resistor installed across "+" and "-" terminals.
Terminals

- AI1 or AI2 (+) Positive Input
- ACOM (-) Negative Input (common)

Accuracy: 0.5% over -40 to 149°F (-40 to 65°C) range.
Isolation: None
Input Impedance: 1MW
Filter: Single pole
Resolution: 10 bits
Conversion Time: 200 µs
Sample Period: 1.0-second minimum

Analog Output

Quality/Type: 0 to 2 Vdc output or 4 to 20 mA current
Terminals

- AO (+) Positive Output
- ACOM (-) Negative Output (common)

Resolution: 8 bits
Accuracy: 0.5% of full-scale output
Reset Action: Output goes to last value (software configurable) on power-up (warm start) or on watchdog time-out

Discrete Input

Quality/Type: Contact-sense discrete input or voltage sourced 3.3 to 24 Vdc
Terminals

- DI1 or DI2 (+) Positive Input
- DCOM (-) Negative Input (common)

Current Rating: 35 µA in the active (on) state, 0 µA in the inactive (off) state
Isolation: None
Frequency: 0.5 Hz maximum
Sample Period: 1.0 second minimum

Discrete Output

Quality/Type: Solid-state switch
Terminals

- DO1 or DO2 (+) normally-open contact
- DCOM (-) common

Switch Rating: 24Vdc @ 12 mA maximum or 12 Vdc @ 10 mA maximum

Environmental

Meets the Environmental specifications of the RegFlo units in which the board is installed.

RTD Interface (optional)

RTD Input

Quantity/Type: Single input for a 2, 3 or 4-wire RTD element with alpha of 0.00385
Sensing Range: -40 to 167°F (-40 to 75°C)
Accuracy: ±1.0°F (-18° to -17°C) over sensing range (includes linearity, hysteresis, repeatability).
Resolution: 16 bits.
Sample Period: 1 sec minimum.

Introduction

Scope of Manual

This instruction manual provides generalized guidelines for successful installation and operation of the RegFlo RF100 Series flow and pressure instruments. Planning helps to ensure smooth installation. Be sure to consider location, ground conditions, climate, and site accessibility as well as the suitability of the application when planning an installation. Refer to the appropriate instruction manuals when installing and maintaining regulators and other equipment used with the RF100 Series instruments.

Product Description

The RF100 Series pressure and flow instruments are devices which measure and archive flow and pressure data. The Type RF110 instrument is used as a stand-alone pressure recorder. The Type RF100 instrument is mounted on a regulator, such as a Type EZR and

can also estimate flow rates as well as record valve plug travel. Other parameters such as minimum and maximum values are also stored. Alarms may be configured to signal abnormal or emergency conditions.

Specifications

Specifications for the RF100 Series instruments are found on page 2. Regulators and other equipment used with the RF100 Series instruments, such as the Type EZR regulator, have their own instruction manuals. Refer to the appropriate manual for installation and operation of additional equipment.

Instantaneous Flow Estimation Accuracy

Type EZR

The instantaneous flow estimation accuracy of the RegFlo Type RF100 instrument is related to the percentage of flow through the Type EZR regulator. As the flow rate through the regulator increases, the instrument's flow estimation becomes more accurate. The typical flow estimation accuracy for each Type EZR body size is shown in table 2.

Note

The percent of flow is not equivalent to percent of travel. The Type EZR regulator does not exhibit a linear valve characteristic. The regulator in most cases will not start to flow through the main valve until the percentage of travel reaches 10% of full open. Refer to the Type EZR Bulletin, 71.2:EZR (D102626X012) capacity tables for the maximum flow of the regulator. The maximum flow is related to inlet pressure and outlet pressure of the regulator.

Table 2. *Type EZR Instantaneous Flow Estimation Typical Accuracy*

DIAPHRAGM MATERIAL	PERCENTAGE OF ACTUAL FLOW			
	2-Inch (DN 50)		3 and 4-Inch (DN 80 and 100)	
	For 20 to 30% of Maximum Flow	For 30 to 100% of Maximum Flow	For 20 to 30% of Maximum Flow	For 30 to 100% of Maximum Flow
17E97 Nitrile	±15	±10	±20	±10
17E67 Nitrile	±20	±15	±20	±15

Field data shows that the RegFlo Type RF100 has the ability to estimate hourly flow rates within ± 5% of the actual flow and daily rates within ± 2% of the actual when the Type EZR regulator is operating at or above mid-range of capacity.

Type 1098-EGR

The instantaneous flow estimation accuracy of the RegFlo Type RF100 instrument is related to the percentage of travel through the Type 1098-EGR regulator. As the flow rate through the regulator increases, the instrument's flow estimation becomes more accurate. The typical flow estimation accuracy for each Type 1098-EGR cage is shown in table 3.

The accuracy is improved at higher pressure drops. The data in table 3 is representative of a 5 to 10 psi (0,34 to 0,69 bar) pressure drop. Accuracy of the pressure sensor at lower pressure drops also has an impact.

Principle of Operation

The main function of RegFlo RF100 Series instruments is the acquisition and storage of pressure, travel, and flow data from the regulator installation. It also provides alarm and diagnostic functions relative to pressure, travel and flow.

The flow algorithm uses upstream and downstream pressure measurements along with travel to calculate an instant and accumulate flow rate. The travel and pressure sensors are integral to the module. It is also available with an optional third pressure sensor. The module may also be mounted remotely and used only to monitor line pressures.

Data storage will be provided in the unit. That data may be accessed via a local interface or remotely. The remote connection may be via dial-up phone or

Table 3. *Type 1098-EGR Instantaneous Flow Estimation Typical Accuracy*

CAGE TYPE	PERCENTAGE OF ACTUAL FLOW				
	For 5 to 10% of Travel	For 10 to 20% of Travel	For 20 to 30% of Travel	For 30 to 40% of Travel	For 40 to 100% of Travel
Linear or Quick Opening	± 30	± 20	± 15	± 10	± 10
Whisper Trim®	± 20	± 17.5	± 15	± 10	± 7.5
Note: The accuracy of the flow estimation is dependant on pressure drop and pressure sensor range.					

radio. The communications ports will support ROC and Modbus protocols. The unit is designed to meet Class 1 Division 1 explosion proof requirements and be submersible. It is DC powered by an internal battery or external source.

Type RF100 Flow and Pressure Instrument

The Type RF100 instrument measures valve plug travel, inlet pressure, and outlet pressure. A third pressure sensor is available as an option to measure an auxiliary pressure. An algorithm estimates the flow through the regulator and archives pressure, travel, and flow data in the history log. It also records other parameters such as battery output, minimums and maximum values, etc. Alarms may be configured to signal abnormal or emergency conditions.

The Type RF100 flow and pressure instrument is available for the 1, 2, 3, 4, and 6-inch (DN 25, 50, 80, 100, and 150) Type EZR and the 2, 3, 4, and 6-inch (DN 50, 80, 100, and 150) Type 1098-EGR body sizes. The flow estimation is not available for the 1-inch (DN 25) Type EZR. It is also not available for the 6-inch (DN 150) Type EZR when the differential pressure exceeds 175 psi (12,1 bar).

Type RF100 Pressure and Travel Indication

The Type RF100 instrument is available for the 1, 3, and 6-inch (DN 25, 80, and 150) Type EZR body sizes as a pressure and travel indicator. The instantaneous flow estimation capability for these sizes is currently not available. Instantaneous flow estimation capability will be added when development of the required Flow Estimation Algorithm is completed. A field installable software update will be available to add the Flow Estimation Algorithm. The unit will not have to be removed from its installation to install the update. Until the software update is installed, the instrument will display the value of zero for the Estimated Flow, Accumulated Flow, and Accumulated Travel values.

FCC Approvals

Note

The RF100 Series instruments have been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules.

The RF100 Series instrument's limits are designed to provide reasonable protection against harmful interference when these instruments are operated in a commercial environment. The RF100 Series instruments generate, use, and can radiate radio frequency energy and, if not installed and used according to the instruction manual, may cause harmful interference to radio communications.

Operation of the RF100 Series instruments in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his/her own expense.

User Instructions

This equipment complies with Part 68 of the FCC rules. On the RF100 Series housing assembly is a label that contains the FCC certification number and the Ringer Equivalence Number (REN). If requested, this information must be provided to the telephone company.

Registration No. US: FSRMR00BI00, REN 0.0B
Registration Holder: Fisher Controls International, Inc.

This instrument is designed to be connected to the telephone network or premises wiring using a compatible modular jack that is Part 68 compliant. See the Installation section for details.

The REN is used to determine the quantity of devices that may be connected to the telephone line. Excessive RENs on the telephone line may result in the devices not ringing in response to an incoming call. Typically, the sum of the RENs should not exceed five (5.0). To be certain of the number of devices that may be connected to a line (as determined by the total RENs), contact the local telephone company.

If the RF100 Series Modem causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. If advance notice is not practical, the telephone company will notify you as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it necessary.

The telephone company may make changes to its facilities, equipment, operations, or procedures that could effect the operation of the RF100 Series Modem. If this happens, the telephone company will provide advance notice so you can make the necessary modifications to maintain uninterrupted service.

For RF100 Series repair or warranty information, please contact your local Fisher Sales Representative or Sales Office. If the RF100 Series Modem is causing

harm to the telephone network, the telephone company may request that you disconnect the modem until the problem is resolved.

Hazardous Area Product Approval for North America

This section contains standards, classifications, techniques, enclosure ratings, and approvals used in hazardous area considerations. The information in this document is primarily for educational purposes and should not be used in place of the source documents.

The specifications and requirements stated in this document constitute minimum information. For more detailed explanations, refer to reference documents or call your Fisher Sales Office or Sales Representative.

Common Standards

Canadian Electrical Code (CEC), 1994, Part I, Section 18—Defines hazardous locations by class, division, and group, and provides installation criteria.

Canadian Standards Association (CSA) C22.2 No. 0-M91—General Requirements—Canadian Electrical Code, Part II.

CSA C22.2 No. 30-MI 986—Explosion-Proof Enclosures for Use in Class I Hazardous Locations.

CSA C22.2 No. 94-1991—Special Purpose Enclosures.

CSA C22.2 No. 142-M1987—Process Control Equipment.

CSA C22.2 No. 157-92—Intrinsically Safe and Nonincendive Equipment for Use in Hazardous Locations.

CSA C22.2 No. 213-MI 987—Nonincendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations.

National Electric Code (NEC), Article 500, 1996— Defines the hazardous area classes, divisions, hones, groups, and provides installation criteria.

National Electrical Manufacturer's Association (NEMA) Standard 250, 1985—Enclosure for Electrical Equipment (1000 Volts Maximum). Describes definitions and standards for electrical enclosures for U.S. installations.

National Fire Protection Association (NFPA) 497M, 1991—Classification of Gases, Vapors, and Dusts for Electrical Equipment in Hazardous (Classified) Locations.

Table 4. *Hazardous Areas Where Types of Protection May Be Used*

TYPES OF PROTECTION	CLASS I, DIVISION 1	CLASS I, DIVISION 2
Explosionproof (XP)	X	X
Nonincendive (NI)	- - - -	X

Note

The following information is provided as an example of the information listed in the National Electrical Code (NEC). Do not use the information in this document in place of the NEC.

Approval Agencies

There are three main approval agencies in North America: Factory Mutual (FM) and Underwriters Laboratories (UL) in the United States, and Canadian Standards Association (CSA) in Canada. The RegFlo RF100 Series instruments are approved by CSA.

Types of Protection

The RegFlo instruments are certified as explosion proof and nonincendive. It is not certified as intrinsically safe. See following definitions.

Explosion-Proof (XP)—A protection concept that requires electrical equipment to be capable of containing an internal explosion of a specific flammable vapor-in-air mixture, thereby not allowing the release of burning or hot gases to the external environment which may be potentially explosive. Also, the equipment must operate at a safe temperature with respect to the surrounding atmosphere.

Intrinsically Safe (IS)—A protection concept that requires electrical equipment to be incapable of releasing sufficient electrical or thermal energy to cause ignition of a specific hazardous substance under "normal" or "fault" operating conditions.

Nonincendive (NI)—A type of protection which requires electrical equipment to be nonsparking and incapable of releasing sufficient electrical or thermal energy to cause ignition of a specific hazardous substance under "normal" operating conditions.

Locations Where Types of Protection Are Used

The various types of protection can be used in the locations designated in table 4.

Nomenclature

Approval agencies within North America classify equipment to be used in hazardous locations by specifying the location as being Class I or II; Division 1 or 2; Groups A, B, C, D, E, F, or G; and Temperature Code T1 through T6. These designations are defined in the National Electrical Code (NEC) in the United States and the Canadian Electrical Code (CEC) in Canada. They are also defined in the following paragraphs.

Hazardous Area Classifications

Hazardous areas in North America are classified by class, division, and group.

Class

The class defines the general nature of the hazardous material in the surrounding atmosphere.

Class I—Locations where flammable gases or vapors are, or may be, present in the air in quantities sufficient to produce explosive or ignitable mixtures.

Division

The division defines the probability of hazardous material being present in an ignitable concentration in the surrounding atmosphere.

Division 1—Locations where the probability of the atmosphere being hazardous is high due to flammable material being present continuously, intermittently, or periodically.

Division 2—Locations presumed to be hazardous only in an abnormal situation.

Note

Any RegFlo instrument approved for Division 1 is automatically approved for Division 2 for the same class and group.

Group

The group defines the hazardous material in the surrounding atmosphere. The specific hazardous materials within each group and their automatic ignition temperatures can be found in Article 500 of the National Electrical Code (NEC) and in NFPA 497M. Groups A, B, C, and D apply to Class I; Groups E, F, and G apply to Class II locations.

Group A—Atmospheres containing acetylene.

Group B—Atmospheres containing hydrogen, fuel and combustible process gases containing more than 30 percent hydrogen by volume, or gases or vapors of equivalent hazard such as butadiene, ethylene oxide, propylene oxide, and acrolein.

Group C—Atmospheres such as ethyl ether, ethylene, or gases or vapors of equivalent hazard.

Group D—Atmospheres such as acetone, ammonia, benzene, butane, cyclopropane, ethanol, gasoline, hexane, methanol, methane, natural gas, naphtha, propane, or gases or vapors of equivalent hazard.

Group E—Atmospheres containing combustible metal dusts, including aluminum, magnesium, and their commercial alloys, or other combustible dusts whose particle size, abrasiveness, and conductivity present similar hazards in the use of electrical equipment.

Group F—Atmospheres containing combustible carbonaceous dusts, including carbon black, charcoal, coal, or coke dusts that have more than 8 percent total entrapped volatiles, or dusts that have been sensitized by other materials so that they present an explosion hazard.

Group G—Atmospheres containing combustible dusts not included in Group E or F, including flour, grain, wood, plastic, and chemicals.

Temperature Code

A flammable gas, vapor-in-air mixture, dust, or fiber may be ignited by coming into contact with a hot surface. The conditions under which a hot surface will ignite a material depends on surface area, temperature, and the concentration of the gas.

The approval agencies test and establish maximum temperature ratings for the different equipment submitted for approval. Equipment that has been tested receives a temperature code that indicates the maximum surface temperature attained by the equipment. For intrinsically safe and nonincendive equipment, the temperature classification marking also applies to surfaces other than those of the enclosure. Table 5 lists the maximum surface temperature for the different temperature codes.

The NEC states that any equipment that does not exceed a maximum surface temperature of 212°F (100°C) [based on 104°F (40°C) ambient temperature] is not required to be marked with the temperature code. Field measurement instruments that do not exceed a maximum surface temperature of 212°F (100°C), will normally not have a temperature code rating on the nameplate. When a temperature code is not specified on the approved apparatus, it is assumed to be T5.

Table 5. *Temperature Code Maximum Surface Temperature*

TEMPERATURE CODE	MAXIMUM SURFACE TEMPERATURE	
	°F	°C
T1	842	450
T2 T2A T2B T2C T2D	572 536 500 446 419	300 280 260 230 215
T3 T3A T3B T3C	392 356 329 320	200 180 165 160
T4 T4A	275 248	135 120
T5	212	100
T6	185	85

CSA Enclosure Rating

CSA enclosure ratings are defined in CSA C22.2, No. 94. They are now similar to the NEMA enclosure ratings; however, CSA does not have Types 1, 7, 8, 9, and 10.

Explosion-Proof Technique

This technique is implemented by enclosing all electrical circuits in housings and conduits strong enough to contain any explosion or fires that may take place inside the instrument.

All electrical wiring leading to the field instrument must be installed in threaded rigid metal conduit, threaded steel intermediate metal conduit, or Type MI cable.

Advantages of this Technique

1. Users are familiar with this technique and understand its principles and applications.

2. Sturdy housing designs provide protection to the internal components of the instruments and allows their application in hazardous environments.

3. An explosion-proof housing is usually weatherproof.

Disadvantage of this Technique

1. Circuits must be de-energized or location rendered nonhazardous before housing covers may be removed.

2. Opening of the housing in a hazardous area voids all protection.

3. Generally requires use of heavy bolted or screwed enclosures.

Installation Requirements

1. The user has responsibility for following proper installation procedures (refer to local and national electrical codes).

2. Installation requirements are listed in Article 501 of the National Electrical Code (NEC) or article 18-106 of the Canadian Electrical Code (CEC).

3. All electrical wiring leading to the field instrument must be installed using threaded rigid metal conduit, threaded steel intermediate metal conduit, or Type MI cable.

4. Installation drawings are not required for explosion-proof instruments, but the equipment must be installed per the NEC or CEC, as appropriate.

5. Conduit seals may be required within 18-inches (457 mm) of the field instrument to maintain the explosion-proof rating and reduce the pressure piling effect on the housing.

Nonincendive Technique

This technique allows for the incorporation of circuits in electrical instruments which are not capable of igniting specific flammable gases or vapor-in-air mixtures under normal operating conditions.

Advantage of this Technique

1. Uses electronic equipment which normally does not develop high temperatures or produce sparks strong enough to ignite the hazardous environment.

2. Lower cost than other hazardous environment protection techniques because there is no need for explosion-proof housings or energy limiting barriers.

3. Permits using wiring methods suitable for wiring in ordinary locations (as allowed by the NEC exception).

Disadvantage of this Technique

1. This technique is only applicable to Division 2 locations.

2. Places constraint on control room to limit energy to field wiring (normal operation is open, short or grounding of field wiring) so that arcs or sparks under normal operation will not have enough energy to cause ignition.

3. Both the field instrument and control room device may require more stringent labeling.

Instrument Repair

Approved instruments can be field repaired under certain limitations as follows:

1. Any replacement of electrical components must be with components specifically designated by Fisher. No substitution of type or vendor is allowed.

2. No machining of explosion-proof instruments which will alter or affect thread engagements, flame paths, minimum wall thickness, gaps, etc. is allowed.

3. No machining of dust-ignition-proof instruments which will alter or affect thread engagements, gaps, etc. is allowed.

4. Nameplates for approved instruments can be changed in the field only by Fisher personnel and under the direct supervision of an FM or CSA representative.

Each instrument must have specific approval from a testing agency in order to qualify as nonincendive.

RF100 Series Installation

WARNING

Personal injury, equipment damage, or leakage due to escaping gas or bursting of pressure-containing parts may result if this device is overpressured or is installed where service conditions could exceed the limits given in the Specifications section on page 2, or where conditions exceed any ratings of the adjacent piping or piping connections.

To avoid such injury or damage, provide pressure-relieving or pressure-limiting devices (as required by the appropriate code, regulation, or standard) to prevent service conditions from exceeding limits.

Additionally, physical damage to the regulator could break the pilot off the main valve, causing personal injury and property damage due to escaping gas. To avoid such injury and damage, install the regulator in a safe location.

Installation Requirements

This section provides generalized guidelines for successful installation and operation of the RF100 Series instruments. Planning helps to ensure a smooth installation. Be sure to consider location, ground conditions, climate, and site accessibility as well as the suitability of the instrument application while planning an installation.

The versatility of the RF100 Series instruments allows them to be used in many types of installations. For additional information concerning a specific installation, contact your Fisher Sales Representative. For detailed wiring information, refer to Wiring section.

The Installation Requirements section includes:

- Site Requirements
- Grounding Installation Requirements

Note

The RF100 Series instruments have been tested and found to comply with the limits for class A digital device pursuant to part 15 of the FCC Rules.

These limits are assigned to provide reasonable protection against harmful interference when the instruments are operated in a commercial environment. These instruments generate, use, and can radiate radio frequency energy. If not installed and used in accordance with this instruction manual, these instruments may cause harmful interference to radio communications.

Operation of these instruments in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his/her own expense.

Site Requirements

Careful consideration in locating the instrument on the site can help prevent future operational problems. The following items should be considered when choosing a location:

- Local, state, and federal codes often place restrictions on monitoring locations and dictate site requirements. Examples of these restrictions are distance from pipe flanges and hazardous area classifications.
- Locate the instrument to minimize the length of signal and power wiring.
- When using solar-power, orient solar panels to face due South (not magnetic South) in the Northern Hemisphere and due North (not magnetic North) in the

Southern Hemisphere. Make sure nothing blocks the sunlight from 9:00 AM to 4:00 PM.

• Antennas equipped for radio communications must be located with an unobstructed signal path. If possible, locate antennas at the highest point on the site and avoid aiming antennas into storage tanks, buildings, or other tall structures. Allow sufficient overhead clearance to raise the antenna.

• To minimize interference with radio communications, locate the instrument away from electrical noise sources such as engines, large electric motors, and utility line transformers.

• Locate the instrument away from heavy traffic areas to reduce the risk of being damaged by vehicles. However, provide adequate vehicle access to aid in monitoring and maintenance.

Grounding Installation Requirements

Ground wiring requirements for line-powered equipment are governed by the National Electrical Code (NEC). When the equipment uses line power, the grounding system must terminate at the service disconnect. All equipment grounding conductors must provide an uninterrupted electrical path to the service disconnect.

The National Electrical Code Article 250-83 (1993), paragraph c, defines the material and installation requirements for grounding electrodes.

The National Electrical Code Article 250-91 (1993), paragraph a, defines the material requirements for grounding electrode conductors.

The National Electrical Code Article 250-92 (1993), paragraph a, provides installation requirements for grounding electrode conductors.

The National Electrical Code Article 250-95 (1993), defines the size requirements for equipment grounding conductors.

Proper grounding of the instrument helps to reduce the effects of electrical noise on the unit's operation and protects against lightning. A surge protection device installed at the service disconnect on line-powered systems offers lightning and power surge protection for the installed instrument. You may also consider a telephone surge protector for the dial-up modem communications card.

All earth grounds must have an earth to ground rod or grid impedance of 25 ohms or less as measured with a ground system tester. The grounding conductor should have a resistance of 1 ohm or less between the instrument case ground lug and the earth ground rod or grid.

The grounding installation method for the instrument depends on whether the pipeline has cathodic protection. Pipelines with cathodic protection do not require grounding, the instrument can "float."

Electrical isolation can be accomplished by using insulating flanges upstream and downstream on the distribution system. In this case, the instrument could be flange mounted or saddle-clamp mounted directly on the distribution system and grounded with a ground rod or grid system.

On pipelines without cathodic protection, the pipeline itself may provide an adequate earth ground and the instrument could mount directly on the distribution piping. Using a ground system tester, test to make sure the pipeline to earth impedance is less than 25 ohms. If an adequate ground is provided by the pipeline, do not install a separate ground rod or grid system. All grounding should terminate at a single point.

Isolate the instrument installation and install a ground rod or grid grounding system, if the pipeline to earth impedance is greater than 25 ohms.

All Installations

The robust design of the RF100 Series instrumentation allows this device to be installed indoors or outdoors. When installed outdoors, the RF100 Series instrument does not require protective housing. This device is designed to withstand the elements.

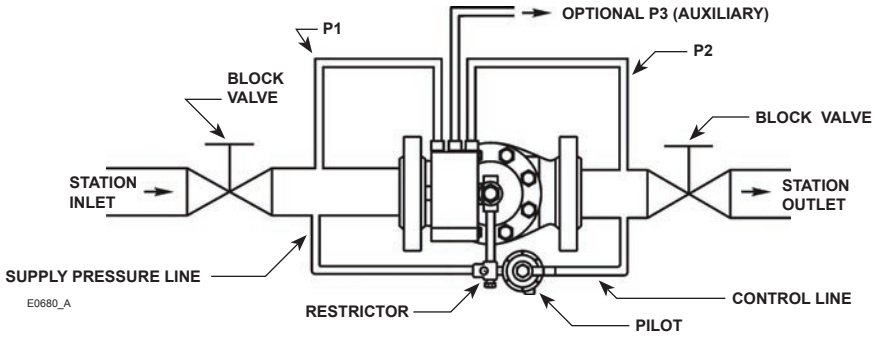
The Type RF100 instrument is installed on the regulator in place of the indicator fitting. The Type RF110 instrument is mounted to a pipe stand or wall remote from the regulator.

When installed indoors, remote venting of the atmospheric vent and mounting adaptor vent is required. This instrument can also be installed in a pit that is subject to flooding by venting the housing atmospheric vent and mounting adaptor vent above the maximum possible flood level. Any other atmospheric reference points, such as a pilot spring case, must also be installed above flood levels.

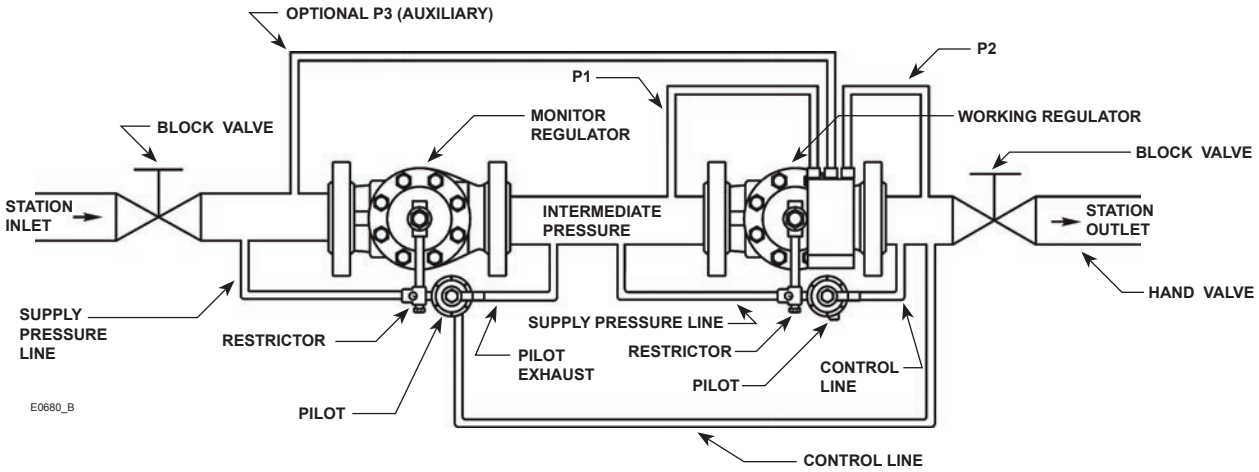
Note

When installed in a hazardous area, appropriate techniques are required. Refer to the Hazardous Area Product Approval section of this manual.

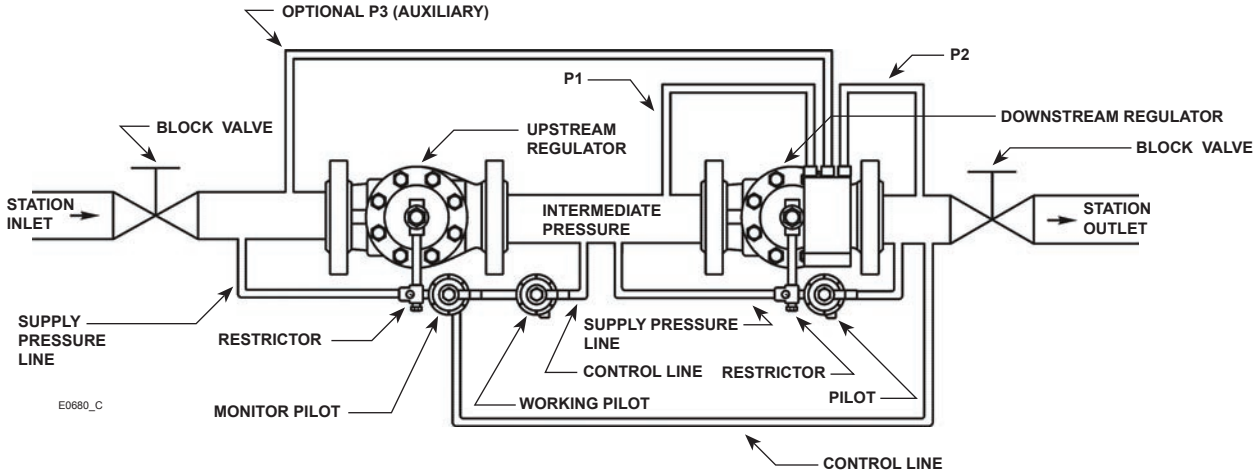
The unit is CSA Class I DIV I explosion-proof and CSA Class I DIV II nonincendive.



***2A**—Single Regulator Installation with 2 or 3 Pressure Sensors Used in the Type RF100 Instrument [Installation Type: Single Cut (Two or Three Sensors)]*

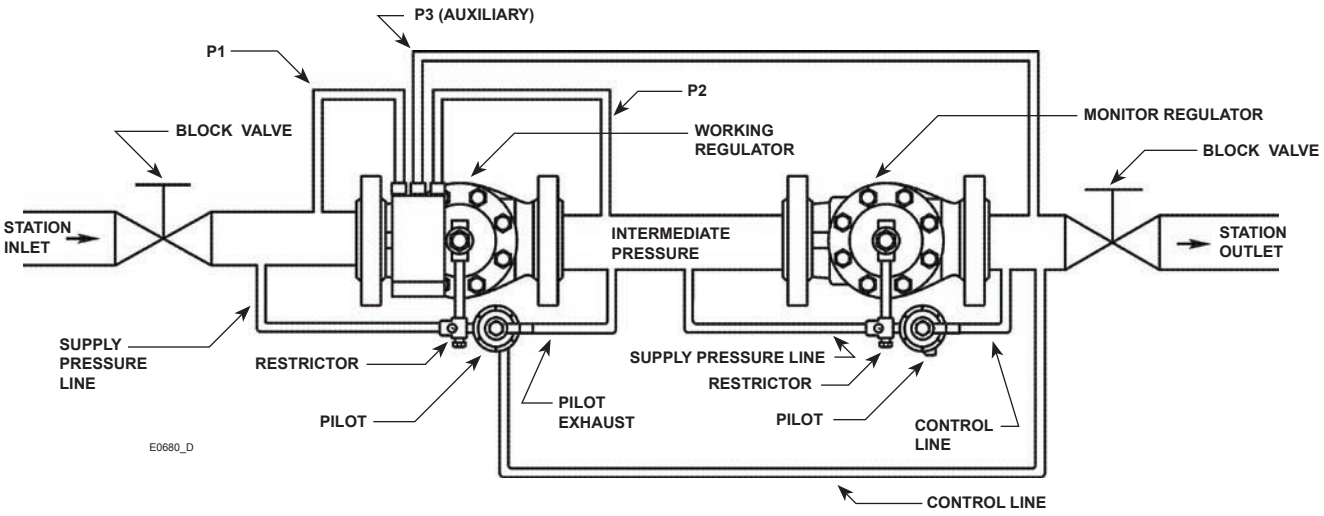


***2B**—Upstream Wide-Open Monitoring System Installation with 2 or 3 Pressure Sensors Used in the Type RF100 Instrument [Installation Type: Downstream RegFlo (Two or Three Sensors)]*

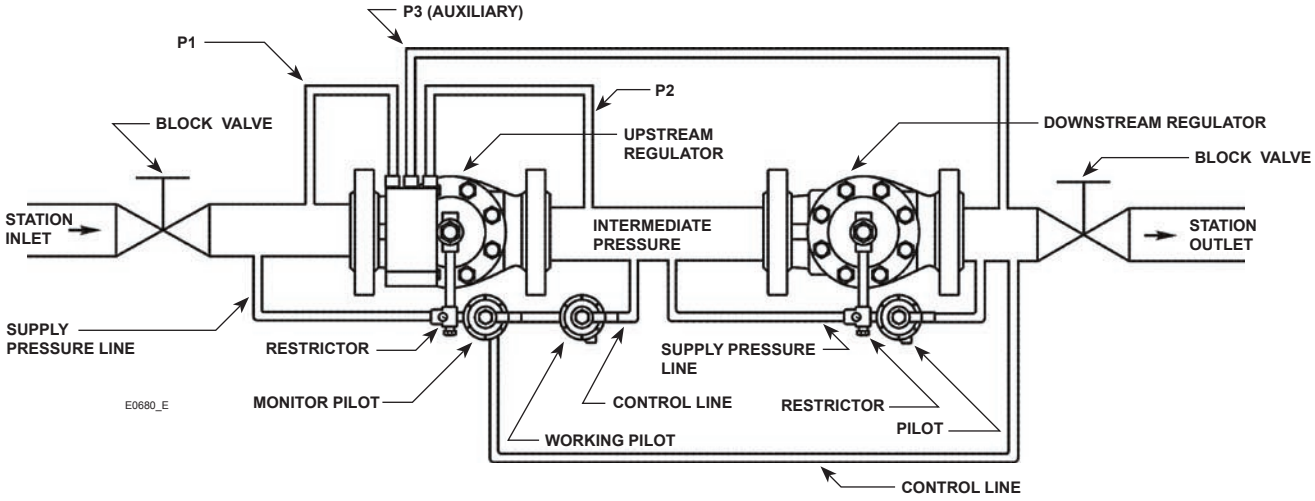


***2C**—Working Monitoring System Installation with 2 or 3 Pressure Sensors Used in the Type RF100 Instrument [Installation Type: Downstream RegFlo (Two or Three Sensors)]*

***Figure 2.** RF100 Series Typical Installations*



***2D**—Downstream Wide-Open Monitoring System Installation with 3 Pressure Sensors Used in the Type RF100 Instrument [Installation Type: Upstream RegFlo (Three Sensors)]*



***2E**—Working Monitoring System Installation with 3 Pressure Sensors Used in the Type RF100 Instrument [Installation Type: Upstream RegFlo (Three Sensors)]*

***Figure 2.** RF100 Series Typical Installations (continued)*

Only personnel qualified through training and experience should install, operate, and maintain a regulator. Also, make sure that all tubing and piping are clean and unobstructed.

Note

If the gas contains continuous particles, upstream filtration is recommended.

An RF100 Series instruments may be installed in any orientation. In order for the Type RF100 instrument to estimate flow, inlet pressure (P_1) must be piped to the inlet connection and outlet pressure (P_2) must be piped to the outlet pressure connection of the regulator.

When changing the orientation of the RF100 Series instrument, refer to the Magnet Rotation Orientation section to properly align the magnet.

Note

Accuracy depends on sensor location. Pressure sensors should be placed 5 to 10 pipe diameters from the valve body with no piping obstructions between the sensing location and the valve body.

P_1 and P_2 are upstream and downstream of the RegFlo regulator.

RegFlo instrumentation accuracy requires the regulator to fully stroke during

calibration. Consideration of this during installation will improve the calibration process. One possible installation would include a means for blocking off the regulator pilot's supply and control lines. Then, by bleeding the loading pressure, the regulator would stroke wide-open.

WARNING

A regulator may vent some gas to the atmosphere. In hazardous or flammable gas service, vented gas may accumulate and cause personal injury, death, or property damage due to fire or explosion.

Vent a regulator in hazardous gas service to a remote, safe location away from air intakes or any hazardous location. Protect the vent line or stack opening against condensation or clogging.

A clogged atmospheric vent may cause incorrect pressure to be recorded. To keep this vent from being plugged or collecting rain, point the vent down. To remotely vent this connection, remove the vent and install obstruction-free tubing or piping into the 1/4-inch NPT vent tapping. Provide protection on the remote vent by installing a screened vent cap onto the remote end of the vent pipe.

Type RF110 Pipestand Mounting

Key numbers are referenced in figure 34.

1. Mount the bracket (key 46) on a 2-inch (50,8 mm) pipestand using the muffler clamps (key 48) provided or mount the bracket to a wall or panel.

2. To assemble, insert the spacer (key 47) through the column of the RegFlo housing (key 1) and place it into the bracket. Insert the carriage bolt (key 49) through the bracket and spacer from the top, securing the unit.

3. Position the unit and tighten using a washer (key 50) and nut (key 51).

4. Connect pressure lines to pressure sensors (key 26) using 1/4-inch NPT fittings (not supplied).

Note

Pressure sensors are factory calibrated. If further calibration is required, refer to the Calibration section of this manual or to the RegLink Software Manual (Form 5669, PN D102780X012)

CAUTION

Guard against overpressuring the sensor assemblies. (Maximum pressures are listed in table 1, page 2)

Retrofitting A Type RF100 To An Existing Type EZR or Type 1098-EGR Regulator

Type RF100 instrument key numbers are referenced in figures 32 and 33.

WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled gas or other process fluid. Before starting to disassemble, carefully release all pressures according to the Shutdown procedure. Use gauges to monitor inlet, loading, and outlet pressures while releasing these pressures.

1. Remove inlet and bleed pressure from the regulator. Refer to the Type EZR or Type 1098-EGR instruction manual for proper procedure.

2. Remove the travel indicator assembly from the regulator bonnet on the Type EZR or remove the indicator fitting from the bonnet on the Type 1098-EGR.

3. Remove the spring protector (if provided) from the Type RF100. Lubricate the O-ring and threads on the mounting adaptor (keys 28 and 10) for Type EZR or the lower indicator fitting (keys 35 and 8) for Type 1098 and thread the Type RF100 into the regulator bonnet.

4. Loosen the indicator housing (key 17) to allow housing to rotate freely on the shuttle sleeve (key 34).

5. Position the housing assembly (key 1) and tighten indicator housing (key 17).

6. To set the travel indicator washer (key 14), hold the indicator cover (key 15) next to the indicator housing (key 17). Screw the hex jam nuts and the indicator washer (keys 20 and 14) down on the indicator stem (key 18) until the washer is even with the lowest marking on the indicator cover. Lightly lubricate the indicator cover threads and install. Replace the indicator protector (key 16).

Note

Make sure vent (key 39) points down.

7. Connect the pressure lines to pressure sensor assembly (key 26) using a 1/4-inch (6,35 mm) fitting (not supplied).

8. Align magnet as described on page 32, Magnet Rotation Orientation and figure 12.

Note

Pressure sensors are factory calibrated. If further calibration is required, refer to the Calibration section of this manual or to the RegLink Software User Manual (Form 5669, PN D102780X012)

CAUTION

Guard against overpressuring the sensor assemblies. (Maximum pressures are listed in table 1, page 2)

9. Calibrate the travel (zero and span) of the Type RF100 instrument. Refer to the Calibration section of this manual or to the RegLink Software User Manual (Form 5669, PN D102780X012).

Wiring

Terminal Wiring Connections

The field terminations are accessed by removing the cover. The termination board connectors use a removable connector that accommodate wiring up to #14 AWG (American Wiring Gauge) in size. The connections are made by baring the end of a copper wire [1/4-inch (6,35 mm) maximum], inserting the bared end into the clamp beneath the termination screw, and then securing the screw. The wire should be fully inserted with a minimum of bare wire exposed to prevent short circuits.

To make connections, unplug the connector from its socket, insert each bared wire end into the clamp beneath its termination screw, secure the screw, and then plug the connector back in. The inserted wires should have a minimum of bare wire exposed to prevent short circuits. Allow some slack when making connections to prevent strain on the circuit board and to provide enough clearance to unplug connectors.

The following connectors are used on the Termination Board (Refer to figure 3):

- TB2—Input Power (not used with battery option)
- TB1—I/O Board (not used with battery option)
- TB3—Communications LOI, COM1, COM2
- P1—Battery Terminal Connection (no wiring required, not shown)

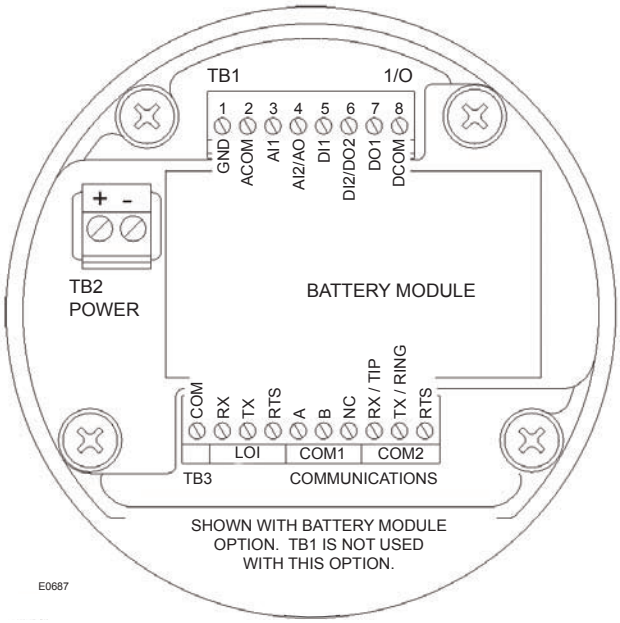


Figure 3. *Wiring Label*

Connecting Communications Wiring

The RegFlo RF100 Series instruments have the flexibility to communicate to external devices using different protocols. Communications take place either through the local operator interface port (LOI) or the Host port (COM1). An optional Host Port (COM2) is also available. Wiring for the Host port is connected using screw terminals on the TB3 termination board. (See figure 3.)

Available Communications Ports

The RegFlo controller provides three communication ports:

- EIA-232 Operator interface port —LOI
- EIA-485 Host Port—COM1
- Dial-Up Modem or EI-232 Host Port—COM2 (optional)

Operator Interface Port—LOI

The Operator Interface port, also called the Local Operator Interface (LOI) port, provides direct communications between the instrument and the serial port of an operator interface device such as an IBM compatible computer.

The interface allows you to access the RegFlo RF100 Series instruments (using the RegLink software) for configuration and transfer of stored data. The LOI terminal on the Termination Board provides wiring access to a built-in EIA-232 serial interface and is capable of up to a 19.2k baud rate. The operator interface port supports only ROC protocol communications. The LOI also supports the log-on security feature of the instrument.

The configuration device is typically an IBM-compatible computer. A prefabricated interface cable is available as an accessory from Fisher.

The LOI port is how the instrument normally communicates with the RegLink software. This port is compatible with RS232 signals. An RTS terminal is provided on the Termination Board and is intended for future applications. The following table shows the signal routing between the Termination Board terminations and the 9-pin serial connector:

(LOI) TERMINATION BOARD	TX	RX	COM
9-Pin Serial	2	3	5

CAUTION

Local configuration or monitoring of the instrument through its LOI port must be performed in a nonhazardous area.

Note

If desired or required, the LOI port may be wired to a more convenient location. Due to the EIA-232 specifications, the location must be within 50 feet (15,2 m) of the RegFlo device.

Host Ports

Host ports are used to monitor or alter the RegFlo instrument from a remote site using a host configuration software. It also supports the log-on security feature of the RegFlo instrument.

The host port is capable of initiating a message in support of Spontaneous Report by Exception (SRBX or RBX). Refer to *RegLink Software User Manual.*

Note

Due to the small enclosure, the radio must be mounted outside of the RegFlo instrument housing.

The communications cards available for the RegFlo instrument allow the options of serial data communication and modem communications. The RegFlo instrument is supplied with an EIA-485 Host Port as standard.

The EIA-485 port is COM1. COM2 is optional and is available as an EIA-232 port or a dial-up modem.

COM1: EIA-485 post connections: A, B
COM2: EIA-232 port connections: RX, TX, RTS
Dial-Up Modem Connections: TIP (green wire), RING (red wire)

Connecting Input Voltage

The following sections describe how to connect the RegFlo RF100 Series instruments to power and ground. RegFlo instruments may be powered with a 10 to 28 Vdc source or an optional battery. Use the following recommendations and procedures to avoid equipment damage.

The terminal designations are printed inside the cover. Refer to figure 3.

CAUTION

Always turn the power to the RF100 Series *off* before you attempt any type of wiring.

To avoid circuit damage when working with the unit, use appropriate electrostatic discharge precautions, such as wearing a grounded wrist strap.

Connecting Main Power Wiring

It is important that good wiring practice be used when sizing, routing, and connecting power wiring. All wiring must conform to state, local, and NEC codes. **The TB2 POWER terminal block can accommodate up to 14 AWG wire.** Input power is monitored by diagnostic Analog Input Point A8.

To make power connections (Refer to figure 3):

1. Unplug the connector from its socket located at TB2 on the Termination Card.
2. Connect the DC power source (DC power supply) to the “+” and “-” terminals. Insert each bared wire end into the clamp beneath its termination screw. Make sure the hookup polarity is correct.
3. Secure the screw.
4. Plug the connector back into the socket at TB2.

CAUTION

It is important to check the input power polarity before turning on the power. No damage will occur if polarity is reversed, however, the unit will not operate.

Connecting Ground Wiring

The RegFlo instrument and related components should be connected to an earth ground if any wires enter the enclosure. The National Electrical Code (NEC) governs ground wiring requirements for all line-powered devices.

There is a ground bar located inside the enclosure at the right-hand side (key 22, figure 34). This ground screw is electrically bonded to the enclosure and provides a screw compression to connect shields from other device earth grounds as needed.

An external lug on the bottom outside of the enclosure (key 23, figure 34) provides a place to connect an earth ground to the enclosure.

It is recommended that 14 AWG wire be used for the ground wiring. Make sure the installation has only one ground point to prevent creation of a ground loop circuit. A ground loop circuit could cause erratic operation of the system.

The electronics are electrically connected to ground screw via the ground wire and ring terminal. The enclosure must be grounded from the ground lug (key 23, figure 34).

Input/Output Termination Points

This section shows how to connect wiring to the I/O. For more detail, see I/O Board Specification sheet on page 3 and Product Electronics on page 32 for direction on modifying the type of I/O on selectable channels.

Analog Inputs

The Analog Input (AI) monitors current loop and voltage input devices. The A/D signal input range is 1 to 5 volts with 10-bit resolution. The terminals for connecting analog input wiring include:

- AI1/AI2 (+) Positive Input
- ACOM (-) Negative Input (common)

The "+" terminal is the positive signal input and the ACOM terminal is the signal common. These terminals accept a voltage signal in the 1 to 5 volt range (see figure 4). Because the ACOM terminal is internally connected to common, the analog input channels function as single-ended inputs only.

Current inputs of 4 to 20 mA can be used with the addition of a 250-ohm resistor across the input terminals. When wiring a 4 to 20 mA current signal, leave the 250-ohm resistor installed between the "+" and ACOM terminals (see figure 5).

Note

When connecting the analog input channel to a voltage device, be sure to remove the 250-ohm resistor from the analog input terminal block.

Analog Outputs

The Analog Output (AO) provides either a 0 to 2 volt signal or a 4 to 20 mA current control. The analog outputs use an 8-bit D/A converter with A/D values of 0 and 255. The Analog Output provided on the I/O termination board connects as follows (see figures 6 and 7):

- AO (+) Positive or control Current
- ACOM (-) Common

Discrete Input

The Discrete Input (DI) monitors the status of relays, solid-state switches, or open collector devices. DI functions support discrete latched inputs and discrete status inputs. The discrete input connects as follows:

- DI1/DI2 (+) Positive
- DCOM (-) Common

The Discrete Input operates by providing a closed contact across terminals "+" and "-" (see figure 8). When a field device, such as a relay contact or open collector is connected across "+" and "-", the closing of the contacts completes the circuit which causes a flow of current between V_S and ground at terminal "-". This current flow activates and is sensed in the DI circuitry that, in turn, signals the RegFlo electronics indicating that the relay contacts have closed. When the contacts open, current flow is interrupted and the DI circuit signals to the RegFlo electronics that the relay contacts have opened.

CAUTION

The Discrete Input is designed to operate only with non-powered discrete devices, such as "dry" relay contacts, open collector devices, or isolated solid state switches. Use of the DI channel with powered devices may cause improper operation or damage.

Discrete Output

The Discrete Output (DO) provides a solid-state switch to control relays and power small electrical loads (see figure 9). The DO connects as follows:

- DO1/DO2 (+) positive
- DCOM (-) Common

The Discrete Output channel is an open collector output. The Discrete Output is a solid-state switch enabled by individual signals from the processor I/O lines and capable of handling 24 Vdc @ 12 mA maximum or 12 Vdc @ 10 mA maximum.

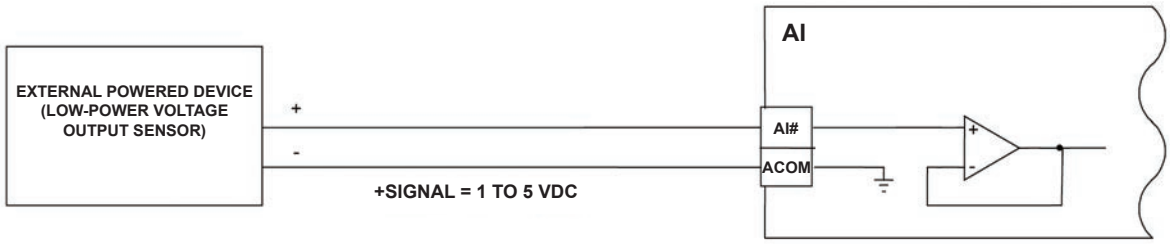


Figure 4. *Voltage Signal on Analog Input*

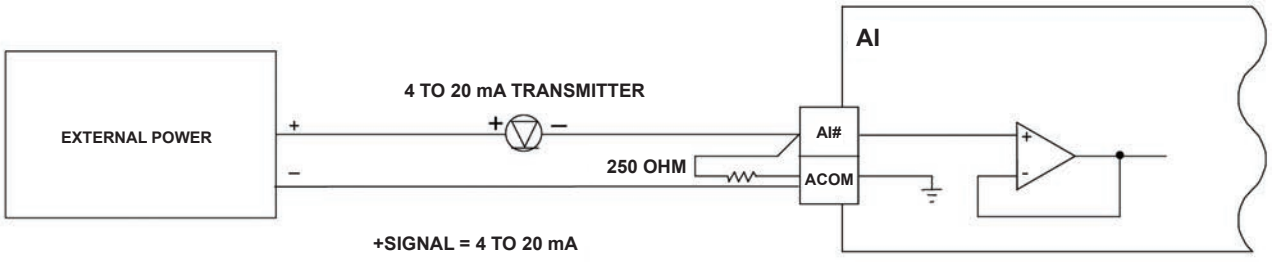


Figure 5. *Current Signal on Analog Input*

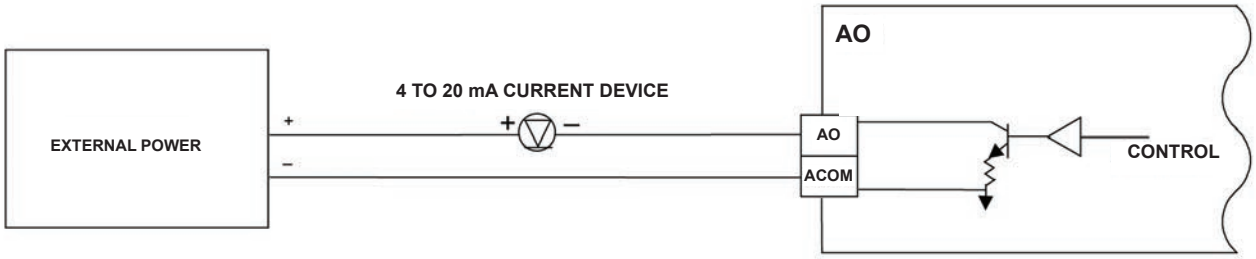


Figure 6. *4 to 20 mA Analog Output Current Control*

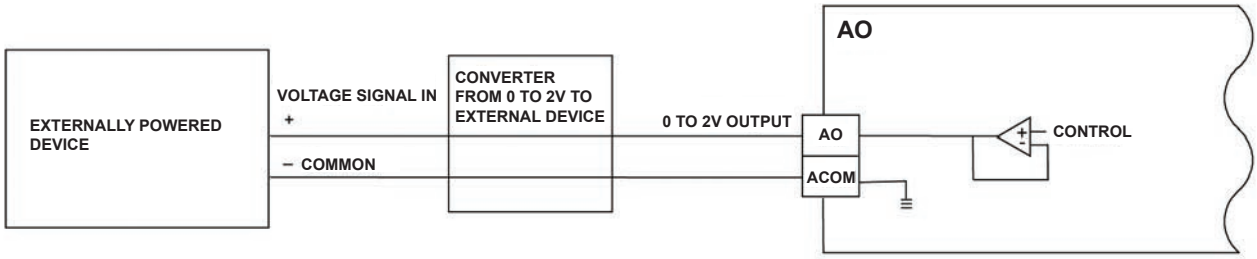


Figure 7. *0 to 2 Volts Analog Output Voltage Control*

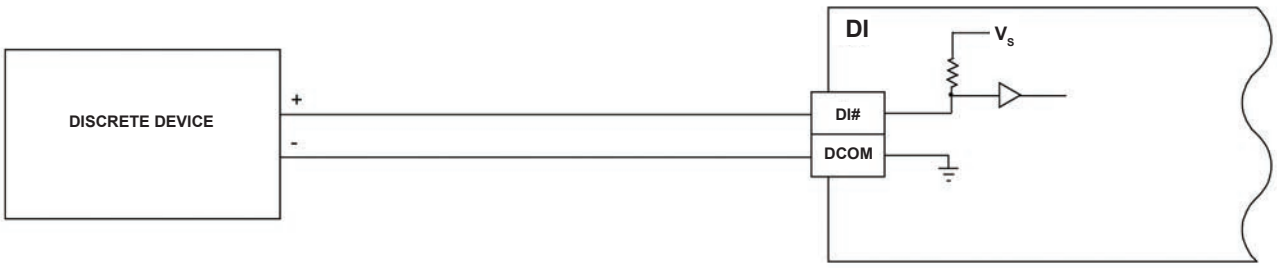


Figure 8. *Discrete Input*

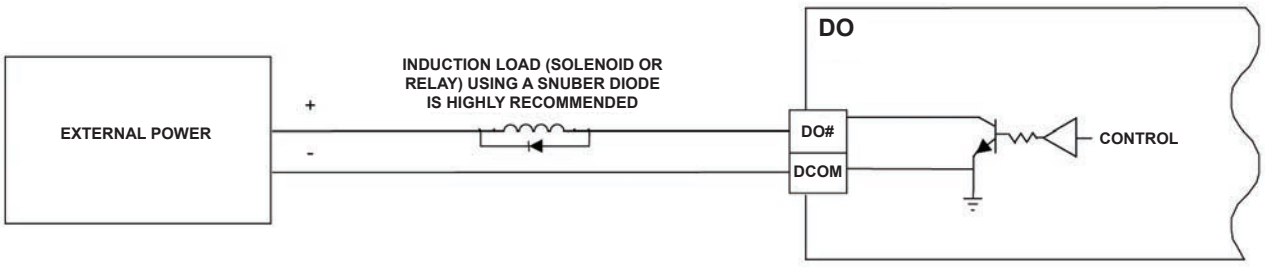


Figure 9. *Solid State Relays - Discrete Output*

The Discrete Output on the I/O termination board can be used in:

- Toggle mode
- Latching mode
- Timed mode

Calibration and Configuration

All field/process inputs must be calibrated to the full range input of the installed sensors.

Analog Inputs

Analog Input calibration routines support a 2-point calibration. The low-end or zero reading (Set Zero) is calibrated first, followed by the high-end or full-scale reading (Set Span). The calculated and diagnostic analog inputs, such as instantaneous flow, accumulated flow, barometric pressure, input voltage, Board temperature, and Logic voltage, are not designed to be field calibrated.

Supported inputs with the 2-point calibration are:

- P_1 Inlet pressure
- P_2 Outlet pressure
- P_3 Auxiliary pressure
- Travel
- I/O Board AI1
- I/O Board AI2

A brief description of the calibration procedure for these inputs is described below.

Refer to the *RegLink Software User Manual* for additional information**.**

Pressure Sensors

The pressure sensors are factory calibrated for their full scale rated pressure. Routines support a two point calibration at zero (open to atmosphere) and at full scale pressure. The general procedure is:

1. Select Tools>Configure Device to display the Configuration window. Select the AI point and select the AI Calibration tab.

2. Click the calibrate button.

3. Calibrate the zero value for the pressure input. This can be done by referencing the sensor to atmospheric pressure. Enter the tester value (in engineering units) and click the Set Zero button. In this case the tester value would be “0”.

4. To calibrate the span value (100% of full scale range) for the pressure input, apply pressure to the sensor for the full scale range. Enter the Tester Value (actual pressure in engineering units) and click the Set Span button. Be sure to allow enough time for the Live Reading to update and stabilize.

5. Confirm that the Live Reading is correct and click Accept or Cancel. If the Live Reading is not correct, select cancel and repeat the procedure.

6. Repeat for each sensor.

Travel Sensor

The travel sensor on the Type RF100 must be calibrated to the travel of the regulator. Routines support a two point calibration at zero (regulator closed) and at full scale (regulator wide open). The general procedure is:

1. Select Tools>Configure Device to display the Configuration window. Select the AI point for travel and select the AI Calibration tab.

2. Click the Calibrate button.

3. Calibrate the zero value (0% of range) for the Travel. This should be with the regulator pressurized and in lock up. Enter “0” for the tester value and click the Set Zero button.

Note

Full stroke of the regulator must be achieved and should be verified to insure RegFlo instrument accuracy.

4. To calibrate the span value (100% of full scale range) for the travel input, stroke the regulator to full open.

For a Type EZR, this can be done by closing the upstream and downstream block valves in addition to any valves on the control line and pilot supply line. Once valves have been closed, exhaust the loading pressure above the diaphragm of the Type EZR. Enter "100" for the Tester Value and click the Set Span button. Be sure to allow enough time for the Live Reading to update and stabilize.

For a Type 1098-EGR, open the control line to atmospheric pressure. The valve plug should travel to the wide-open position. Enter the appropriate value for the Tester Value and click the Set Span button. This value is "100" when travel stops are not used. When restricted trim is used this may be another value depending on how you have configured the instrument. Refer to the RegLink Software User Manual for additional information.

CAUTION

When stroking the regulator wide open, be sure to protect the pressure sensors from overpressure.

5. Confirm that the Live Reading is correct and click Accept or Cancel. If the Live Reading is not correct, select cancel and repeat the procedure.

System Configuration

Several parameters under the Configure, System menu require input and confirmation prior to startup. The System options allow customization and set the parameters for the flow estimation application and Logic Alarms.

Sample Interval

The System screen under Configure Device allows you to configure the Sample Interval. The Sample Interval is how often a sample is taken of Analog Input values. The RF100 Series instrument electronics will go into a low power mode between samples. This allows the power consumption to be minimized. The more frequent the RF100 Series instrument samples the Analog Inputs, the more power is consumed, or the shorter the battery life. The default Sample Interval is 1 minute unless the I/O board is installed in which case the Sample Interval is 1 second. See table 6 to determine power requirements for the device. The following selections for Sample Interval are provided:

- 1 second
- 2 minute
- 10 second
- 5 minute
- 30 second
- 10 minute
- 1 minute
- 30 minute

Periodic Log Interval

The System screen under Configure Device allows you to configure the Log Interval for Periodic and Extended History files. The Log Interval is the rate sampled values are logged to the History file. For example, if a 60 minute Log Interval is selected, the History log will include a log record for every 60 minute interval. The selection of Log Intervals influences the memory capacity of the History log. The Periodic History log will store 840 of the most current records and the Extended History log will store 8640 of the most current records. See the product Specifications on page 2 for further information. The following selections for the Periodic Log Interval are provided.

- 1 minute
- 2 minute
- 3 minute
- 4 minute
- 5 minute
- 6 minute
- 10 minute
- 12 minute
- 15 minute
- 20 minute
- 30 minute
- 60 minute

Log intervals for the Extended History log include the above plus 10, 20, and 30 seconds.

Regulator Parameters (Type RF100 only)

Use the Regulator screen under Configure, System to configure parameters relative to the regulator type, size, material, and construction. Other parameters, such as specific gravity and temperature of the gas must also be specified. The user has the option to use a different temperature for each month of the year in the flow calculation.

The user may also configure the type of regulator installation. The Installation Type is used for setting the default Logic Alarms.

Single Cut (2 or 3 sensors) — Refer to figure 2A. The Type RF100 is installed on a single pressure cut and the unit in measuring the inlet and outlet pressure of the regulator. An optional third pressure could measure another pressure at the installation.

Downstream RegFlo Instrument (2 sensors) — Refer to figures 2B and 2C. In an Upstream Wide-Open System, it is recommended that the RegFlo instrument be installed on the working (downstream) regulator. In a Working Monitoring System, the Type RF100 may be installed on either regulator. In this case, it is installed on the downstream regulator. The inlet pressure (P_1) sensor is monitoring the pressure between the two regulators (intermediate pressure) and the outlet pressure (P_2) sensor is monitoring the station outlet pressure.

Downstream RegFlo Instrument (3 sensors) —This is the same as the Downstream RegFlo instrument (2 sensors) with the additional auxiliary (P_3) sensor monitoring the station inlet pressure.

Upstream RegFlo Instrument (3 sensors) — Refer to figures 2D and 2E. In a Downstream Wide-Open System, it is recommended that the RegFlo instrument be installed on the working (upstream) regulator. In a Working Monitoring System, the Type RF100 may be installed on either regulator. In this case, it is installed on the upstream regulator. The inlet pressure (P_1) sensor is monitoring the station inlet pressure and the outlet pressure (P_2) sensor is monitoring the pressure between the two regulators (intermediate pressure). The auxiliary (P_3) sensor is monitoring the station outlet pressure.

Custom — Any other installation type not defined above. This selection will clear all of the default Logic Alarms.

Communication Ports

The RegFlo communication ports provide a data link to the RegLink software and host systems. Configuration of the RegFlo communications ports can be performed by selecting Comm Ports under the Configure menu. This screen configures the Comm Ports available for the RegFlo device and not the personal computer you are using. Available Comm Ports are as follows:

- Local Operator Interface (LOI) — EIA-232 for use with RegLink (Standard)
- COM1 (Host) — EIA-485 Serial Communications (Standard)
- COM2 (Host) — Dial up modem or EIA-232 Serial Communications (Optional)

The Local Operator Interface port supports Fisher ROC protocol. The Host ports support Fisher ROC and Modbus protocols on the same channel. Refer to the RegLink Software User Manual (Form 5669, D102780X012) for further information.

The COM2 host port also supports Spontaneous Report by Exception (RBX). The feature allows the RegFlo instrument to call-in to a host computer when an alarm occurs. This is also configured with the CommPort screen by enabling the RBX alarming radio button.

Modbus Configuration

The RegFlo instrument supports Modbus Function Codes 3 and 16 over communications ports COM1 and COM2. All RegFlo values are read or written as Floating-point values. See table 6 for the default assignments and descriptions for Function Code 3.

For further details of the Modbus functionality, refer to the RegLink Software User Manual (Form 5669, D102780X012), September 2005.

Alarms

Alarms may be set for each of the Analog Inputs (listed below). High, Low, Hi/Hi, and Lo/Lo alarms are available. Each Analog Input alarm may also be set for RBX alarming. A record of the alarms is stored in the Alarm Log. The Alarm Log stores 240 of the latest alarms. See table 6.

Logic Alarms

The Logic Alarms can be accessed from the Configure Device window and are used to set alarms that link multiple parameters and conditions together. Inlet pressure (P_1), outlet pressure (P_2), auxiliary pressure (P_3), travel and flow are the available parameters. Conditions of greater than, less than, or not applicable may be set for each parameter to compare the parameter to an entered value. A default list of Logic Alarms is displayed if the Installation Type has been configured on the System screen. Up to 10 different alarms may be configured per device.

Each Logic Alarm may also be set for RBX alarming. A record of the alarms is stored in the Alarm Log. The Alarm Log stores 240 of the latest alarms. The following is a description of the default alarms by installation type:

Table 6. *Modbus Register Assignments*

MODBUS REGISTER	POINT NUMBER	TYPE	DESCRIPTION
7001	0	AI	P_1 inlet pressure
7002	1	AI	P_2 outlet pressure
7003	2	AI	P_3 auxiliary pressure
7004	3	AI	Travel
7005	4	AI	Instantaneous flow
7006	5	AI	Accumulated flow
7007	6	AI	Barometric pressure
7008	7	AI	Input voltage
7009	8	AI	Board temperature
7010	9	AI	Logic (battery) voltage
7011	16	AI	I/O Board AI1 Filtered EUs
7012	17	AI	I/O Board AI2 Filtered EUs
7013	18	AO	I/O Board AO EUs
7014	19	DI	I/O Board DI1 Status
7015	20	DI	I/O Board DI2 Status
7016	21	DO	I/O Board DO1 Status
7017	22	DO	I/O Board DO2 Status
Note: If an I/O Board channel does not exist, a value of 0.0 is returned.			

Single Cut or Downstream RegFlo (2 Sensors) Installation Type

Shutoff — Alarm is set when the travel of the regulator is less than or equal to zero (closed) and the outlet pressure (P_2) is above the lockup pressure of the regulator or station. It is set to acknowledge that the regulator is still allowing gas to pass through the orifice or pilot. User must input the appropriate lock up pressure.

Capacity — Alarm is set when the travel of the regulator is greater than zero (open) and the outlet pressure (P_2) is below the setpoint and offset of the regulator. It is set to acknowledge that the regulator is not satisfying the demand of the system. User must input the appropriate setpoint and offset pressure.

Closed — Alarm is set when the travel of the regulator is less than or equal to zero (closed) and the outlet pressure (P_2) is below setpoint and offset of the regulator. It is set to acknowledge that the regulator is in the closed position and not opening to satisfying the demand of the system. User must input the appropriate set point and offset of the regulator.

Open — Alarm is set when the travel of the regulator is greater than zero (open) and the outlet pressure (P_2) is above the lockup pressure of the regulator or station. It is set to acknowledge that the regulator is in the open position and not closing to respond to the decreased demand of the system. User must input the appropriate lock up pressure.

Downstream RegFlo Instrument (3 sensors) Installation Type

Shutoff—Same as the Downstream RegFlo instrument (2 sensors) Installation Type

Capacity—Same as the Downstream RegFlo instrument (2 sensors) Installation Type

Closed—Same as the Downstream RegFlo instrument (2 sensors) Installation Type

Open—Same as the Downstream RegFlo instrument (2 sensors) Installation Type

Monitor—Alarm is set when the travel of the regulator is greater than zero (open) and the RegFlo instrument inlet pressure (P_1) or station intermediate pressure is below the normal operating range. In addition, the alarm is monitoring the station inlet pressure (P_1) to ensure that it is at or above the normal operating range. It is set to acknowledge that the station is being controlled by the Monitor regulator or pilot and that the worker has failed in the open position. User must input the appropriate normal operating pressures for station inlet and station intermediate.

Upstream RegFlo Instrument (3 sensors) Installation Type

Shutoff — Alarm is set when the travel of the regulator is less than or equal to zero (closed) and the auxiliary pressure (P_3) is above the lockup pressure of the regulator or station. It is set to acknowledge that the regulator is still allowing gas to pass through the orifice or pilot. The user must input the appropriate lock up pressure.

Capacity—Alarm is set when the travel of the regulator is greater than zero (open) and the auxiliary pressure (P_3) is below the setpoint and offset of the regulator. It is set to acknowledge that the regulator is not satisfying the demand of the system. The user must input the appropriate setpoint and offset pressure.

Closed—Alarm is set when the travel of the regulator is less than or equal to zero (closed) and the auxiliary pressure (P_3) is below setpoint and offset of the regulator. It is set to acknowledge that the regulator is in the closed position and not opening to satisfying the demand of the system. The user must input the appropriate set point and offset of the regulator.

Open—Alarm is set when the travel of the regulator is greater than zero (open) and the auxiliary pressure (P_3) is above the lockup pressure of the regulator or station. It is set to acknowledge that the regulator is in the open position and not closing to respond to the decreased demand of the system. The user must input the appropriate lock up pressure.

Monitor—Alarm is set when the travel of the regulator is greater than zero (open) and the RegFlo outlet pressure (P_2) or station intermediate pressure is below the normal operating range. In addition, the alarm is monitoring the station inlet pressure (P_1) to ensure that it is at or above the normal operating range. It is set to acknowledge that the station is being controlled by the Monitor regulator or pilot and that the worker has failed in the open position. The user must input the appropriate normal operating pressures for station inlet and station intermediate.

History Log

Data is recorded and stored in the History Log. The user can view this file from an on-line device or from a disk file with RegLink software. History files may

be converted to common spreadsheet and database formats. There are three types of History files in the RF100 Series. One file is used to store the points on a daily basis. The daily history file stores 35 days of data.

The Periodic file, the second type of history file, is used to store the points for the log interval selected in the System screen. The Periodic file stores 840 logs of 20 history points. The type of history stored in the Daily and Periodic files can be configured by the user.

Minimum and maximum values are stored in the same History file as the other points. A minimum and maximum value for specific parameters is recorded for each base time record.

The third type of History file is the Extended History file. This file stores 8640 logs of ten history points. This is equivalent to 30 days of five minute increments. The points and log interval can be configured by the user.

Security

The RF100 Series instrument has security features to limit access. The device may include up to 15 unique users and passwords. Access levels may be specified to control who is allowed access to menus and screens in the RegLink software.

Battery Module

This new and improved battery module design extends battery life and ensures sufficient voltage at low temperatures. It cannot be used in conjunction with external power or I/O Board; and it is not rechargeable. Table 8a shows the life expectancy of the battery in months for the different configurations. The Average Current Draw shown in table 8b can be used to size external power systems or batteries.

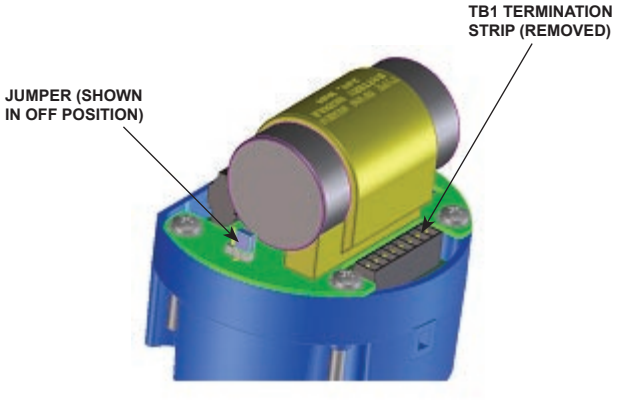


Figure 10. *Battery Module*

I/O Board Power Consumption

Table 7 and the following directions can be used to calculate the incremental current draw for the I/O board. The outcome should be added to the value shown in the 1 second sample rate column in table 8b to determine the total power requirements.

Table 7. *Input / Output Board Average Current Draw*

CONFIGURATION TYPE (SELECT ONE)	QUANTITY	I_A (mA)	I_B (mA)	DUTY CYCLE %	POWER SUPPLY (VOLTAGE)	POWER REQUIREMENT SUBTOTAL
2-AI, 2-D1, 1-DO	1	0.340	0.340	100%	12	4.08
2-AI, 1-D1, 2-DO	0	0.320	0.320	100%	12	0
1-AO, 1-AI, 2-D1, 1-DO	0	0.690	0.690	100%	12	0
1-AO, 1-AI, 1-D1, 2-DO	0	0.685	0.685	100%	12	0
					Subtotal (Base I/O card)	4.08 mW
INDIVIDUAL MODULES	**QUANTITY**	**I_A (mA)**	**I_B (mA)**	**DUTY CYCLE %**	**POWER SUPPLY (VOLTAGE)**	**SUBTOTAL**
AI[1]	1	0.0050	0.005	25%	12	0.06
AI[1]	1	0.015	0.005	25%	12	0.15
AO[1]	0	0.020	0.110	0%	12	0
DI1[2]	1	0.000	0.475	25%	12	1.425
DI2[2]	1	0.000	0.275	25%	12	0.825
DO1[2]	1	0.000	0.315	25%	12	0.945
DO2[2]	0	0.000	0.315	0%	12	0
					Subtotal (Individual Modules)	3.405 mW
					Total	7.485 mW
					Average Current Draw	0.624 mA

1. Duty Cycle is % of time at 50% or above.
2. Duty Cycle is % of time in Closed State.

I/O Board Current Draw Example

1. Fill in shaded areas. Select one configuration type then fill in the appropriate quantity of individual modules of the configuration.

2. Calculate the requirements for the base I/O board configuration (Duty Cycle is always 100%):

Quantity * I_B * Power Supply Voltage = Power Requirements

3. Subtotal the consumption for the base I/O board.

4. Fill in the Duty Cycle of the Individual Modules.

5. Calculate the requirement using the Duty Cycle of each channel.

Duty Cycle = Active Time / (Active Time + Inactive Time)
= 15 secs / 60 secs = 0.25 = 25%

Quantity * [I_A * (1-Duty Cycle) + I_B * Duty Cycle]
*** Power Supply Voltage = Power Requirements**

6. Subtotal the consumption for the Individual Modules.

7. Add the values from steps 3 and 6 together and divide by the power supply voltage to get average current draw.

8. Add the result of step 7 to the appropriate value in table 8b. The sample rate is 1 second when I/O board is installed. This is your total average current draw.

Solar Panel and Battery Sizing Example

The two important elements in a solar installation are solar panels and batteries. Solar panels and batteries must be properly sized for the application and geographic location to ensure continuous, reliable operation. To determine solar panel output requirements, first determine the Average Current Draw for the devices being powered and the solar insolation for your geographic area. Average current draw can be found in table 8b. The example uses the Average Current Draw for a 1 minute sample interval, the Scheduled Auto Answer modem available for

Table 8a. *Battery Life Expectancy*

COMMUNICATIONS MODE	MONTHS OF BATTERY LIFE(1)						
	Sample Interval(2)						
	10 seconds	30 seconds	1 minute	2 minutes	5 minutes	10 minutes	30 minutes
Base Consumption(3)	9	22	35	49	66	74	81
Scheduled Auto Answer (30m)(4)	8	17	24	30	35	38	39
Scheduled Auto Answer (10m * 8hr)(5)	7	14	19	23	26	27	28
Scheduled Auto Answer (Full Time)(6)	2	3	3	3	3	3	3
Power up on Ring Modem(7)	8	19	27	35	43	46	49
Only RS232 Card(7)	8	20	30	40	50	54	58
Only RS485 Card(7)	8	17	24	29	35	37	38
Powered Modem and RS485 card(7)	7	14	19	23	26	27	28

1. Assumes usable battery capacity is 80 percent (allows for operating temperature and shelf life).
2. The battery should not be used with a 1 second sample interval.
3. Base Consumption assumes no Host communications and one connection (15 minute) with local RegLink once per week.
4. Scheduled Auto Answer (30m) assumes that modem is active for 30 minutes per day and has a 5 minute phone connection per day.
5. Scheduled Auto Answer (10m * 8 hr) assumes that the modem is active for 80 minutes per day and has a 5 minute phone connection per day.
6. Scheduled Auto Answer (Full Time) assumes that the modem is active all of the time to receive a communication.
7. Assumes a 5 minute connection per day.

Table 8b. *Average Current Draw excluding I/O*

COMMUNICATIONS MODE	AVERAGE CURRENT DRAW (mA)(1)							
	Sample Interval							
	1 second	10 seconds	30 seconds	1 minute	2 minutes	5 minutes	10 minutes	30 minutes
Base Consumption(2)	11.779	1.426	0.659	0.468	0.372	0.314	0.295	0.282
Scheduled Auto Answer (30m)(3)	11.974	1.621	0.854	0.663	0.567	0.509	0.490	0.477
Scheduled Auto Answer (10m * 8hr)(4)	12.182	1.829	1.062	0.871	0.775	0.717	0.698	0.685
Scheduled Auto Answer (Full Time)(5)	17.579	7.226	6.459	6.268	6.172	6.114	6.095	6.082
Power up on Ring Modem(6)	11.883	1.530	0.763	0.572	0.476	0.418	0.399	0.386
Only RS232 Card(6)	11.881	1.528	0.761	0.570	0.474	0.416	0.397	0.384
Only RS485 Card(6)	12.107	1.754	0.987	0.796	0.700	0.642	0.623	0.610
Powered Modem and RS485 card(6)	12.178	1.834	1.067	0.876	0.780	0.722	0.703	0.690

1. Average Current Draw when device is externally powered.
2. Base Consumption assumes no Host communications and one connection (15 minute) with local RegLink once per week.
3. Scheduled Auto Answer (30m) assumes that modem is active for 30 minutes per day and has a 5 minute phone connection per day.
4. Scheduled Auto Answer (10m * 8 hr) assumes that the modem is active for 80 minutes per day and has a 5 minute phone connection per day.
5. Scheduled Auto Answer (Full Time) assumes that the modem is active all of the time to receive a communication.
6. Assumes a 5 minute connection per day.

communications full time and 1.5 hours of insolation. Calculate the amount of current (I_{array}) required from the solar array per day using the following equation.

I_{array} = [Average Current Draw (6.268 mA) x 24 (hrs)] ÷ 1.5 hrs of Insolation = 100.3 mA

Convert this value to amps by dividing by 1000 (1 amp is equal to 1000 mA).

I_{array} = 100.3 mA ÷ 1000 = 0.1003 amps

Finally, the output current of the panel (I_{panel}) is used to calculate the number of solar panels required using the following equation:

Number of Panels = I_{array} amps ÷ (I_{panel} amps/panel) = _____ panels

For our example, if I_{array} equals 0.1003 amps, and I_{panel} equals 0.29 amps for a 5-watt panel (typical), then the number of panels required equals 0.35, which would be rounded up to 1. The "I_{panel}" value varies depending on the type of solar panel installed. Refer to the vendor's specifications for the solar panel being used.

Batteries are used to supplement both line-powered and solar-powered installations. When used in line-powered installations, the batteries serve as backup in case of line power failure. When used in solar installations, they provide power for the instrument when the solar panels are not generating sufficient output.

Typical battery configurations use a 12-volt, sealed, lead-acid battery. These configurations typically provide 7 amp-hours of capacity. Batteries can be connected in parallel to achieve more current capacity. The amount of battery capacity required for a particular installation depends upon the power requirements of the equipment and days of reserve (autonomy) desired.

Battery reserve is the amount of time that the batteries can provide power without discharging below 20 percent of their total output capacity. For solar-powered units, a minimum reserve of five days is recommended, with ten days of reserve preferred. Add 24 hours of reserve capacity to allow for overnight discharge.

To determine the battery capacity requirements, multiply the Average Current Draw by the amount of reserve time required. The Average Current Draw is shown in table 8b. The value is shown in mA and needs to be converted to amps for use in the following equation:

System Requirement = Average Current Draw (amps) x Reserve hrs = _____ amp-hrs

Continuing with our example. The Average Current Draw would be 0.006268 amps. Using 11 days (264 hours) of reserve capacity, the system requirement would be 1.7 amp-hrs. In this case, a battery with any more than 1.7 amp-hours would meet the requirements.

Battery Module Installation and Replacement (refer to figure 10)

1. To activate the battery power output, remove the jumper from the battery module and replace it over the center pin and pin marked I (on position). The pin marked 0 (off position) will not be covered by the jumper. The battery should be stored in the off position to maintain life expectancy.

2. Remove the TB2 External Power Connector and TB1 I/O Termination Strip.

3. Remove the four screws and washers that hold the Electronics Module in place.

4. Plug the battery into the electronics module and replace the four screws and washers to hold the assembly in place.

Startup and Operation

Before starting the instrument, perform the following checks to ensure the unit is properly installed.

- Be aware of the grounding requirements of your installation.
- Check the field wiring for proper installation.
- Make sure the input power has the correct polarity.
- Make sure the input power is fused at the power source.

CAUTION

It is important to check the input power polarity before turning on the power. No damage will occur if polarity is reversed, however, unit will not operate.

When installing equipment in a hazardous area, ensure that all components are approved for use in such areas. Check the product labels.

Startup

Apply power to the instrument by plugging the input power terminal block into the connector labeled POWER or installing the battery.

Operation

Once startup is successful, it is necessary to configure the instrument to meet the requirements of the application. The Calibration and Configuration section details the procedure for configuring the recorder and calibrating the I/O. Once the recorder is configured and calibrated, it can be placed into operation. Refer to the *RegLink Software Users Manual* for additional information.

CAUTION

Local configuration or monitoring of the recorder through its LOI port must be performed only in an area known to be nonhazardous.

During operation, the instrument can be monitored (to view or retrieve current and historical data) either locally or remotely. Local monitoring is accomplished by using RegLink software on a PC connected through the LOI port. Remote monitoring is performed through the Host port (COM1) or COM2 (optional) of the instrument, using either RegLink or Host software. Refer to the *RegLink Software User Manual* for more information.

Assembly and Maintenance

Unit Assembly

Note

Ensure that the assembly is performed at a nonmagnetic workstation.

When removing tubing fittings from the RF100 Series pressure sensors, hold the sensor flats in place with a wrench while removing the fitting. Failure to do so may result in damage to the electronics assemblies inside the enclosure.

Printed Wire Board (PWB) Cup

CAUTION

The assembly of the PWB cup must be done at a workstation that has adequate antistatic protection. Assembly personnel must wear antistatic protection while handling printed circuit boards used in this assembly.

Removing PWB Cup Assembly from Housing (figures 32, 33 and 34)

1. Loosen the cover lock screw (key 7) and remove the cover (key 5). Remove the PWB cup assembly by disconnecting any external wiring and removing the four screws (key 42). Carefully rotate the PWB cup assembly counterclockwise while gently pulling the cup out of the housing, exposing the sensor wires in the rear of the cup.

2. Unplug the pressure sensor wiring from the sensor board and remove the PWB cup assembly (key 25).

PWB Assemblies-to-PWB Cup

Refer to figure 31 for components board layout.

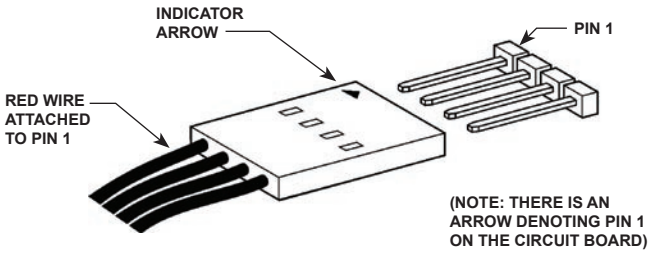
1. Remove the two self-tapping screws and the PWB retainer exposing the PWBs. The following boards are included in this assembly:

- Sensor Board
- Processor Board
- Communication Board (optional)
- RAM Backup Board
- I/O Board (optional)

Note

The notched side of the cable assembly should be aligned with the silkscreening on the printed circuit board. Insert the board into the slot nearest the cable assembly until firmly seated into the terminal board connector.

2. Install the metal PWB retainer with gasket by aligning the PWB tabs and cup bosses with the slots and holes in the retainer. Attach the retainer with self-tapping screws, taking care not to overtighten.



Mounting PWB Cup Assembly in Housing

Install the cup gasket (key 43) on the end of the cup assembly (key 25) with retainer attached. Placing a small amount of lubricant on the gasket face will aid in future removal. Position the PWB cup assembly over the die-cast housing (key 1). Plug the sensor connectors into the appropriate headers on the sensor board. TB2 is used for the P_2 and P_3 sensors and TB3 for the P_1 sensor. Align pin 1 on the sensor connectors with pin 1 on the header.

Note

P_3 sensor connector attaches next to the PWB surface. P_2 connector plugs into the top row of pins on TB2.

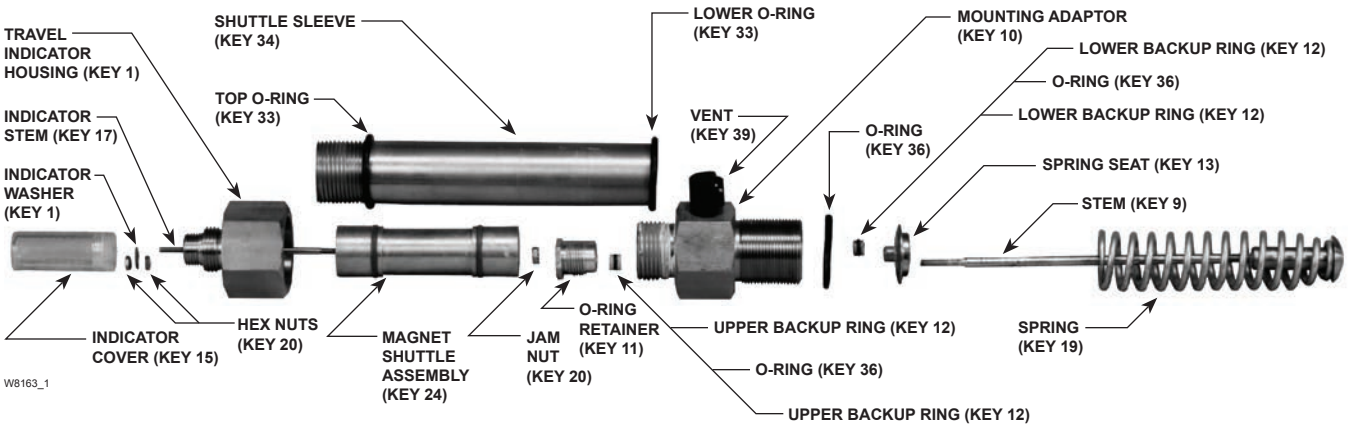


Figure 11. *Type EZR Travel Indicator Parts*

CAUTION

When inserting the PWB cup assembly (key 25), take care not to pinch the wires between the PWB cup assembly and the housing (key 1).

Once all sensor cables are connected, rotate the cup one or two turns clockwise to twist the wires together. Then, lower the assembly into the housing and firmly press into position. Attach the cup assembly to the die-cast housing with four machine screws and lock washers (keys 41 and 42). Reattach the ground wire.

Pressure Sensor Replacement

CAUTION

Do not remove pressure sensor before unplugging from PWB Cup Assembly.

Due to a temperature compensation procedure performed at the factory on each pressure sensor, sensors should not be changed out in the field. If you require a different range, please contact your local Fisher Sales Representative or Sales Office.

Travel Indicator Assembly Maintenance

Type EZR (figure 11)

This procedure is necessary to change out the stem O-rings (key 36) or backup rings (key 12) or if the Type EZR main valve spring needs to be changed.

Note

Perform maintenance at a nonmagnetic (i.e. no metal surfaces) workstation.

Removal

1. Remove inlet and bleed pressure from the Type EZR. Refer to the Type EZR instruction manual for proper procedure.

2. Remove Type RF100 from Type EZR by removing adaptor mounting (key 10) from the valve bonnet.

3. Remove indicator protector (key 16), and cover (key 15) then remove the indicator jam nuts (key 20) and washer (key 14).

4. Remove the indicator housing (key 17) and the top O-ring (key 33). Slide the housing (key 1) off the shuttle sleeve (key 34) and remove the lower O-ring (key 33). Carefully remove the shuttle sleeve (key 34) from the mounting adapter (key 10).

CAUTION

Take care not to bend the valve stem once the shuttle sleeve is removed.

Magnet shuttle should not come in contact with magnetic tools or surfaces.

5. Carefully compress the valve spring (key 19) and loosen the jam nut (key 20) on the lower end of the magnet shuttle assembly (key 24) and remove the shuttle assembly observing orientation.

CAUTION

Magnet shuttle should be guarded against any direct impact or dropping.

Note

Magnet shuttle must be reassembled with the arrow pointing towards the regulator.

The magnet shuttle assembly is factory sealed and not field repairable.

6. Remove the jam nut and O-ring retainer (key 11) and pull the stem (key 9) from the mounting adapter.

CAUTION

Removing the stem with the O-ring retainer installed can damage the O-rings.

7. The spring and O-rings will now be free. If necessary, use the stem to remove the O-rings and backup rings from the mounting adapter.

Replacement

Lubricate all O-rings, backup rings, and threads.

1. Place spring (key 19), spring seat (key 13) lower backup rings (key 12) and O-ring (key 36) on the stem (key 9) then insert the stem through the mounting adapter (key 10).

2. Place the upper backup rings (key 12) and O-ring (key 36) on the stem then replace the O-ring retainer (key 11) and tighten firmly.

3. Place the jam nut (key 20) on the stem and thread down all the way, compressing the spring.

4. Replace the magnet shuttle assembly (key 24) on the stem until tight, making sure to replace with the arrow pointing towards the regulator.

5. While compressing the spring, thread the jam nut against the shuttle assembly and tighten. Replace the remaining parts in reverse order of removal.

Type 1098-EGR (figure 33)

This procedure is necessary to change out the stem O-rings (key 27) or backup rings (key 12). If access or maintenance to the main valve spring is required, refer to the Accessing the Main Valve Spring section.

Note

Perform maintenance at a nonmagnetic (i.e. no metal surfaces) workstation.

Removal

1. Remove inlet and bleed pressure from the Type 1098-EGR. Refer to the Type 1098-EGR instruction manual for proper procedure.

2. Remove indicator protector (key 16), and cover (key 15), then remove the indicator jam nuts (key 63) and washer (key 14).

3. Remove the indicator housing (key 17) and the top O-ring (key 33). Slide the housing (key 1) off the shuttle sleeve (key 34) and remove the lower O-ring (key 33). Carefully remove the shuttle sleeve (key 34) from the mounting adapter (key 10).

CAUTION

Care take not to bend the valve stem once the shuttle sleeve is removed.

Magnet shuttle should not come in contact with magnetizable tools or surfaces.

4. Loosen the flanged nut (key 61) on the lower end of the magnet shuttle assembly (key 24) and remove the shuttle assembly.

CAUTION

Magnet shuttle should be guarded against any direct impact or dropping.

Removing the stem with the O-ring retainer installed can damage the O-rings.

Note

Magnet shuttle must be reassembled with the arrow pointing towards the regulator.

The magnet shuttle assembly is factory sealed and not field repairable.

5. Remove the flanged nut (key 61) and upper O-ring retainer (key 59). Remove the mounting adapter (key 10). Remove the backup rings (key 12) and stem O-rings (key 27) from the top of the mounting adapter (key 10) and from the stem (key 9).

Replacement

Lubricate all O-rings, backup rings, and threads.

1. Slide the first set of backup rings (key 12) and stem O-ring (key 27) on to the stem (key 9) until they contact the lower O-ring retainer (key 60). Install the mounting adapter O-ring (key 30) onto the mounting adapter (key 10). Install the mounting adapter into the lower fitting (key 8). Slide the second set of backup rings and stem O-ring on the stem. Install the upper O-ring retainer (key 59).

2. Place the flanged nut (key 61), flanged side facing upward, on the stem and thread down all the way.

3. Install the magnet shuttle assembly (key 24) on the stem until tight, making sure the direction arrow is facing toward the regulator.

CAUTION

Magnetic shuttle assembly must be tightened firmly against the stem first, before contacting the flanged nut, in order to insure proper RegFlo function.

4. Thread the flanged nut against the magnetic shuttle assembly and tighten. Replace the remaining parts in reverse order of removal.

To Access Type 1098-EGR Main Valve Spring

This procedure is necessary if access to the main valve spring (key 19) and associated components, including optional travel stop (key 64), is required.

Note

Ensure that the maintenance is performed at a nonmagnetic (i.e. nonmagnetizable surfaces) workstation.

The stem assembly (key 9) is a permanent assembly and must be replaced as an assembly.

Removal

1. Refer to steps 1 through 5 of the Travel Indicator Assembly Maintenance section for removal of the RegFlo housing (key 1) and associated parts.

2. Replace the mounting adapter (key 10) and upper O-ring retainer (key 59) making certain NOT to replace the O-rings (key 27) and backup rings (key 12), which may be damaged by the stem (key 9). Install the jam nut (key 61), with the flanged side facing downward, turning it only until the threads of the stem (key 9) protrude from the top.

3. Remove the entire Spring/Mounting Assembly from the valve body, which includes the flanged nut, upper O-ring retainer, mounting adapter, lower O-ring retainer (key 60), lower indicator fitting (key 8), spring (key 19) and stem assembly, by removing the lower indicator fitting.

4. Since some compression is left in the spring, carefully remove the flanged nut.

5. Slide the remaining assembled parts off the stem to expose the spring and travel stop, if applicable.

Note

The stem assembly (key 9) is a permanent assembly and must be replaced as an assembly.

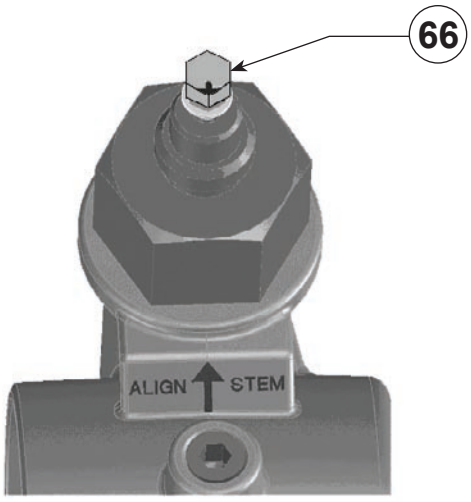


Figure 12. *Proper Magnet Rotation Orientation*

Replacement

Lubricate all O-rings, backup rings, and threads.

1. Install the lower fitting assembly, which includes the lower fitting (key 8), lower O-ring retainer (key 60), mounting adapter (key 10) and upper O-ring retainer (key 59), over the stem (key 9). Install the flanged nut (key 61), flanged side facing down, pushing on the lower fitting assembly if necessary to provide sufficient stem thread exposure.

2. Install this entire Spring/Mounting Assembly onto the Type EGR body flange. To aid this process, the spring may be compressed further by turning the flanged nut down on the stem until sufficient lower fitting thread engagement is reached.

3. Remove the flanged nut, upper O-ring retainer, and mounting adapter.

4. Slide the first set of backup rings (key 12) and stem O-ring (key 27) on to the stem (key 9) until they contact the lower O-ring retainer (key 60). Install the mounting adapter O-ring (key 30) and mounting adapter (key 10). Slide the second set of backup rings (key 12) and stem O-ring (key 27) on the stem (key 9). Replace the upper O-ring retainer (key 59).

5. Install the flanged nut (key 61), flanged side facing upward, on the stem and thread down all the way.

6. Install the magnet shuttle assembly (key 24) on the stem, turning until tight, making sure to replace with arrow pointing towards the regulator.

7. Thread the flanged nut against the magnetic shuttle assembly and tighten. Replace the remaining parts in reverse order of removal, which was described in the Removal portion of the Travel Indicator Assembly and O-ring Maintenance section.

RTD Interface Wiring Schematics

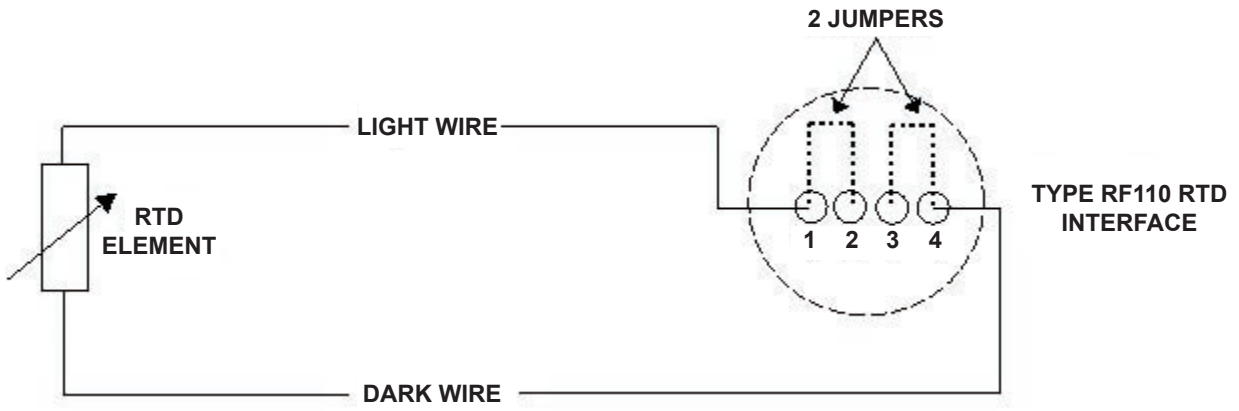


Figure 13. *2-Wire RTD*

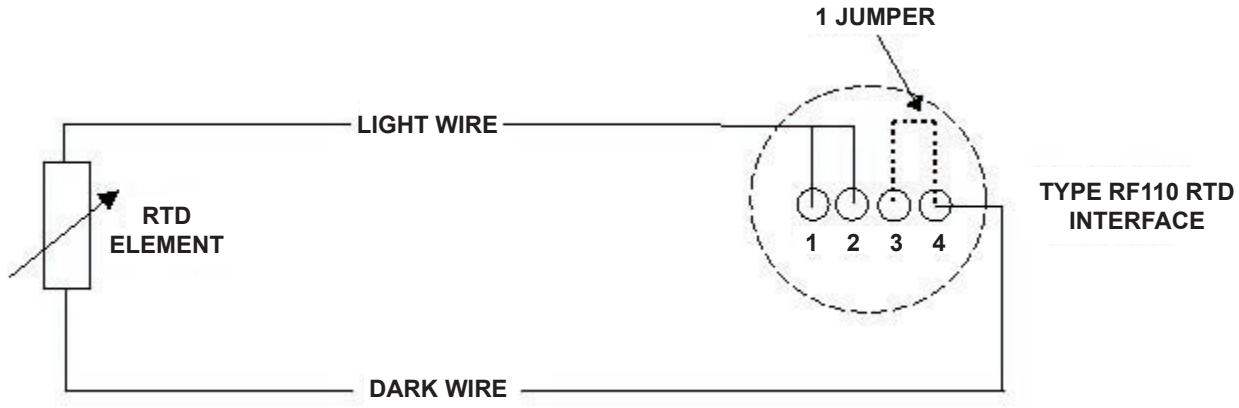


Figure 14. *3-Wire RTD*

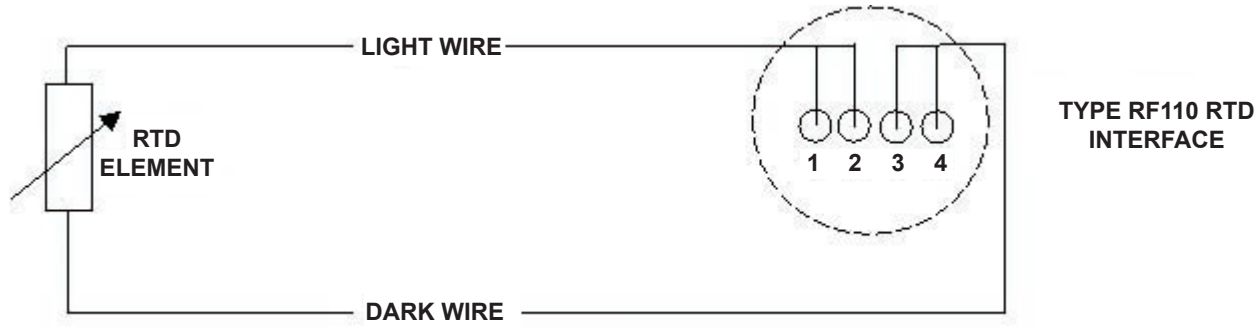


Figure 15. *4-Wire RTD*

RTD Installation Instructions

Figure 16. *Removing RTD Interface Cover*

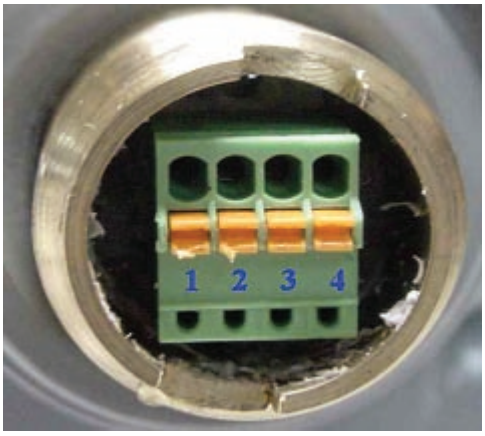


Figure 18. *RTD Wiring Terminal Block (Unlabeled)*

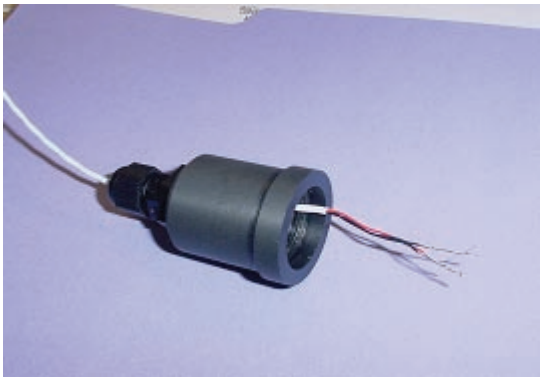


Figure 17. *Inserting Wires through RTD Cover*

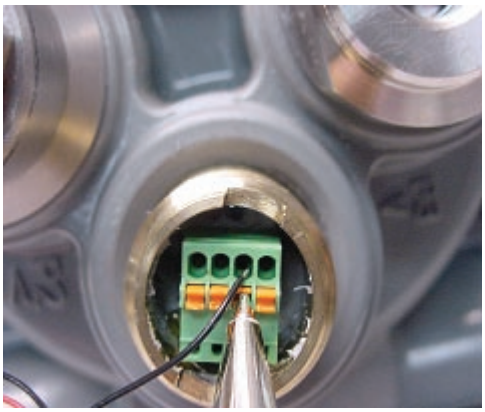


Figure 19. *Inserting Wires to the RTD Wiring Terminal Block*

1. Remove RTD Interface Cover (key 26) from bottom of Type RF110 housing (figure 16).

2. Insert RTD wires through the Cover (key 26) (figure 17).

3. Note numbering orientation for RTD wire interface (figure 18).

Note

Actual RTD interface housing is not labeled.

4. Wire insertion method is to depress orange tab with small tool (figure 19), e.g., ballpoint pen, and then insert RTD wire into the corresponding slot while depressing orange tab.

Note

RTD wires are to be inserted into the larger of the two hole arrays, located closest to the orange tabs. Releasing orange tab will lock the wire to green housing.

The Type RF110 RTD Interface will accept a 2, 3, and 4-wire RTD input as shown in following figures. Slots 1 and 2 are interchangeable with each other. Slots 3 and 4 are also interchangeable with each other.

Note

Using the RTD Interface will change the Approval Classification of the unit to CSA Class 1, Division 2.

2-WIRE RTD

When using a 2-wire RTD, e.g. one dark and one light colored wire; install one of the wires into Slot 1 or 2, and the other wire into Slot 3 or 4. Install two jumpers to bridge the adjacent, unused slots (figure 20). Jumpers can be made by using standard RTD wire, similar gage insulated wire, or similar.

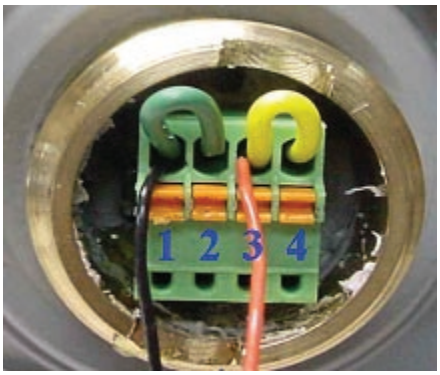


Figure 20. *2-Wire RTD with TWO required jumpers*

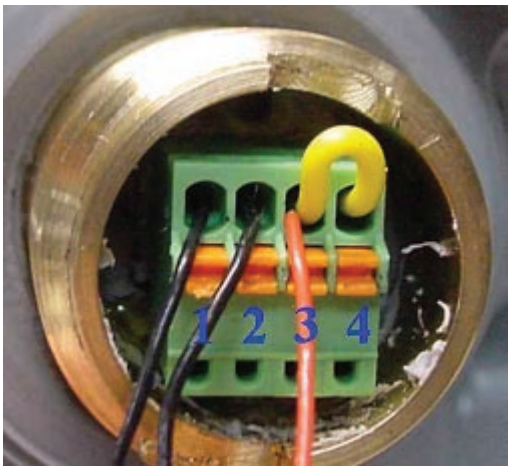


Figure 21. *3-wire RTD with ONE required jumper*

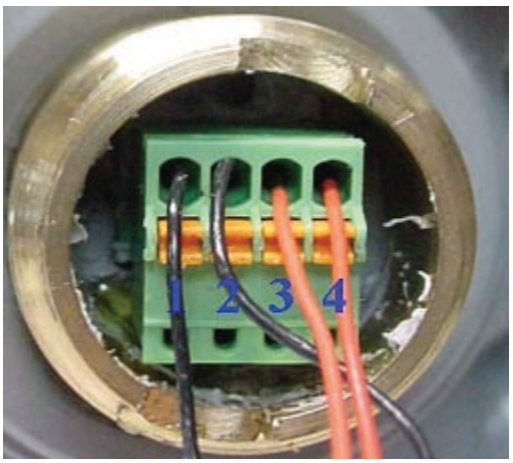


Figure 22. *4-wire RTD*

Figure 23. *Thread cover onto RTD Interface sleeve*

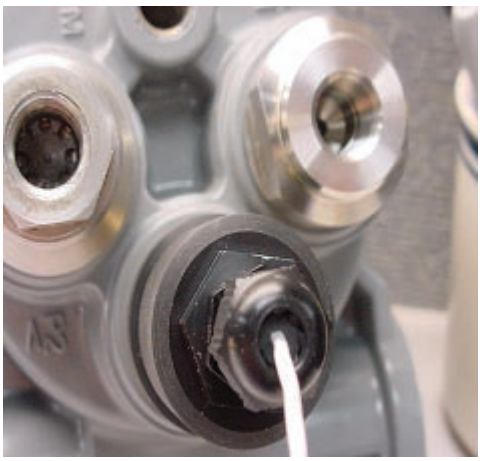


Figure 24. *Completed RegFlo RTD Interface and Wiring*

3-WIRE RTD

When using a 3-wire RTD, install the alike colored wires into Slots 1 and 2. Install the oppositely colored wire into Slot 3 or 4. Install a jumper to bridge the adjacent, unused slot (figure 21).

4-WIRE RTD

When using a 4-wire RTD, install the light colored wires into either Slots 1 and 2 or Slots 3 and 4. Install the dark colored wires into the remaining slots. No jumpers are required when a 4-wire RTD is used.

5. Tighten cord grip around RTD wire, by twisting in a clockwise manner, in order to create a snug, watertight seal around the RTD wiring (figure 24).

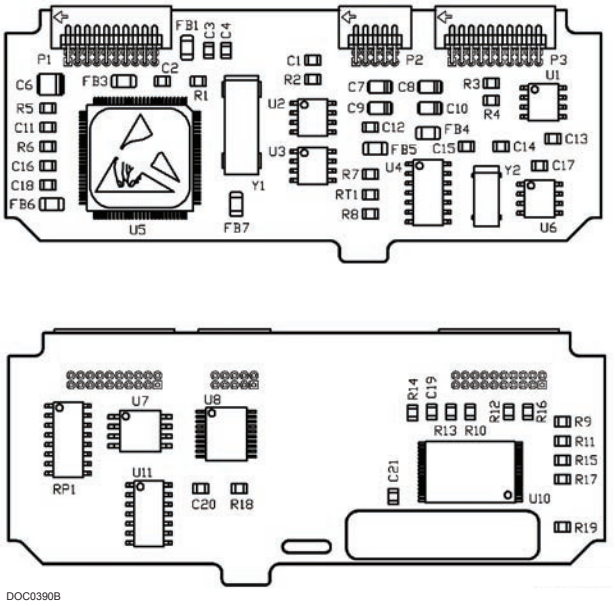


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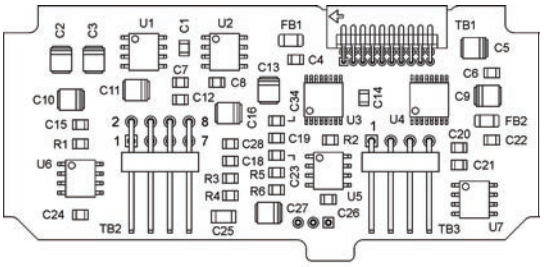
Figure 25. *Main Processor Card*



E0690

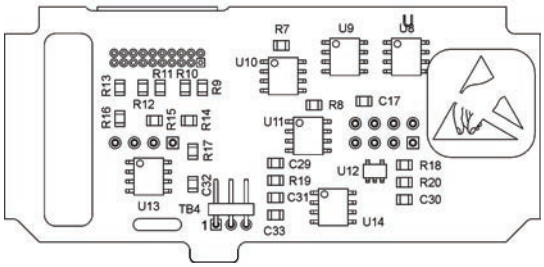


Figure 26. *Sensor Card*

Magnet Rotation Orientation

When changing the orientation of the RF100 Series instrument, the magnet must be rotated to match the orientation of the instrument. To change the magnet orientation, remove the indicator protector (key 16) and indicator cover (key 15). Using a wrench, align the arrow on the indicator cap (key 66) with the arrow on the housing assembly (key 1) by turning the indicator cap clockwise. See figure 12.

Note

Make sure to align the arrow on Indicator Cap (key 66) with the arrow on the Housing Assembly (key 1) by turning the indicator cap clockwise.

Product Electronics

This section describes the electronics of the RegFlo RF100 Series instrumentation. The electronic components support the functionality of the RF100 Series instruments. The board layout is shown in figure 25. The following boards are provided:

Termination Board—The termination board provides connections to the field wiring. These connections are power, LOI communications, COM1 communications, Modem communications, and the optional I/O field terminations. The termination board also serves as a backplane with connectors and signal routing between boards for the Processor board, Sensor board, Optional communications board (Modem or RS-232 driver), and the optional I/O board.

Processor Board (figure 25)—The processor board contains the processor, all memory (static RAM and serial EEPROM), LOI RS-232 communications driver, COM1 RS485 communications driver, the reset controller, and the real time clock. Connections are provided for interface to the termination board for signals to the pressure sensor board, optional modem, and the optional I/O board.

Sensor Board (figure 26)—The pressure sensor board contains the A/D converters, power switches, instrumentation amplifiers, and voltage references for the P_1, P_2, P_3, and barometric sensors and the travel sensor. The barometric sensor is mounted on this board. Connectors are provided for interface to the termination board and connection to the P_1, P_2, P_3, and Hall Effect sensors.

Battery Module (figure 10)—The battery module contains a D-size lithium battery providing 19 amp-hours of current at 3.6 volts. The module is designed to be intrinsically safe and is field replaceable.

RAM Backup Board (figure 27)—This board contains a 3.6 volt, 0.4 amp-hour lithium battery which provides backup power to the RAM and real-time clock on the processor board.

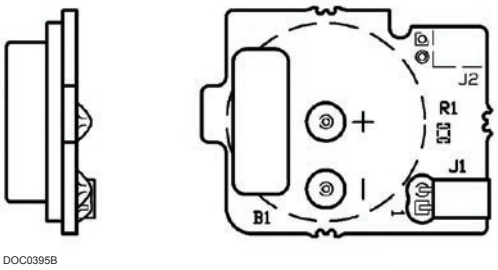


Figure 27. *RAM Backup Card*

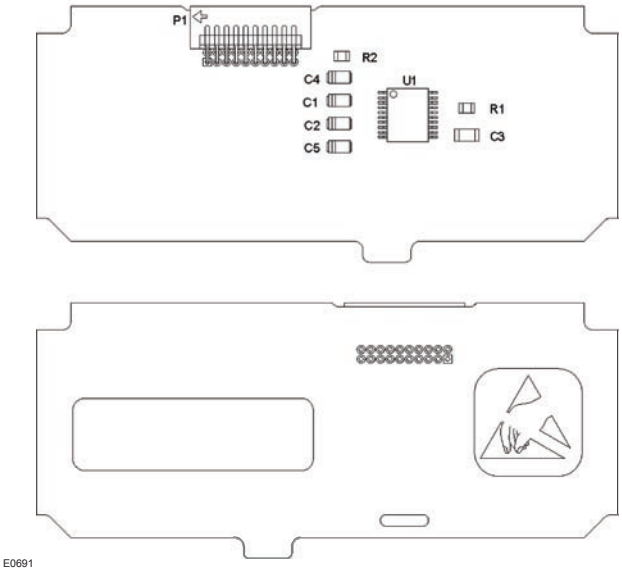


Figure 28. *RS-232 Comm Card*

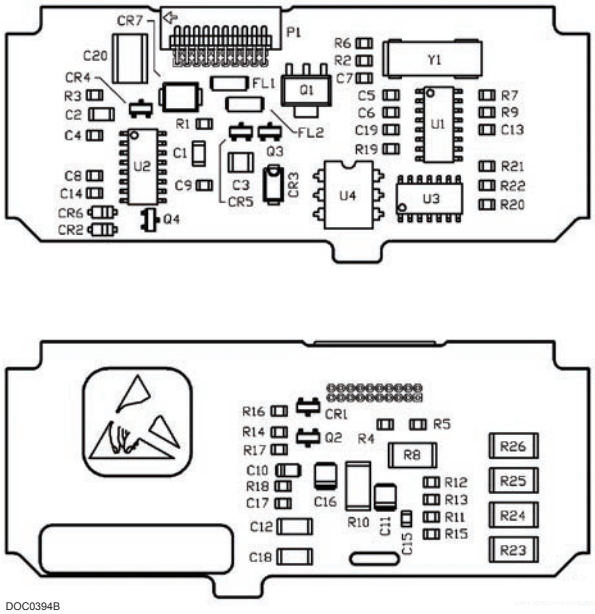


Figure 29. *Modem Card*

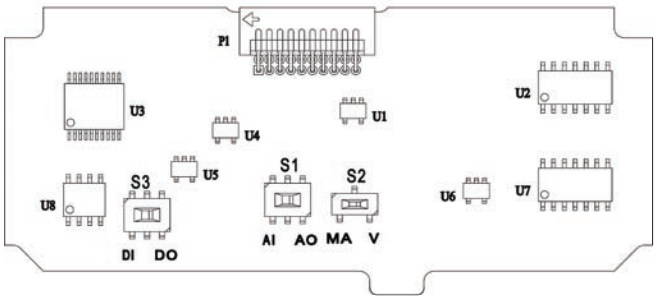


Figure 30. *I/O Board*

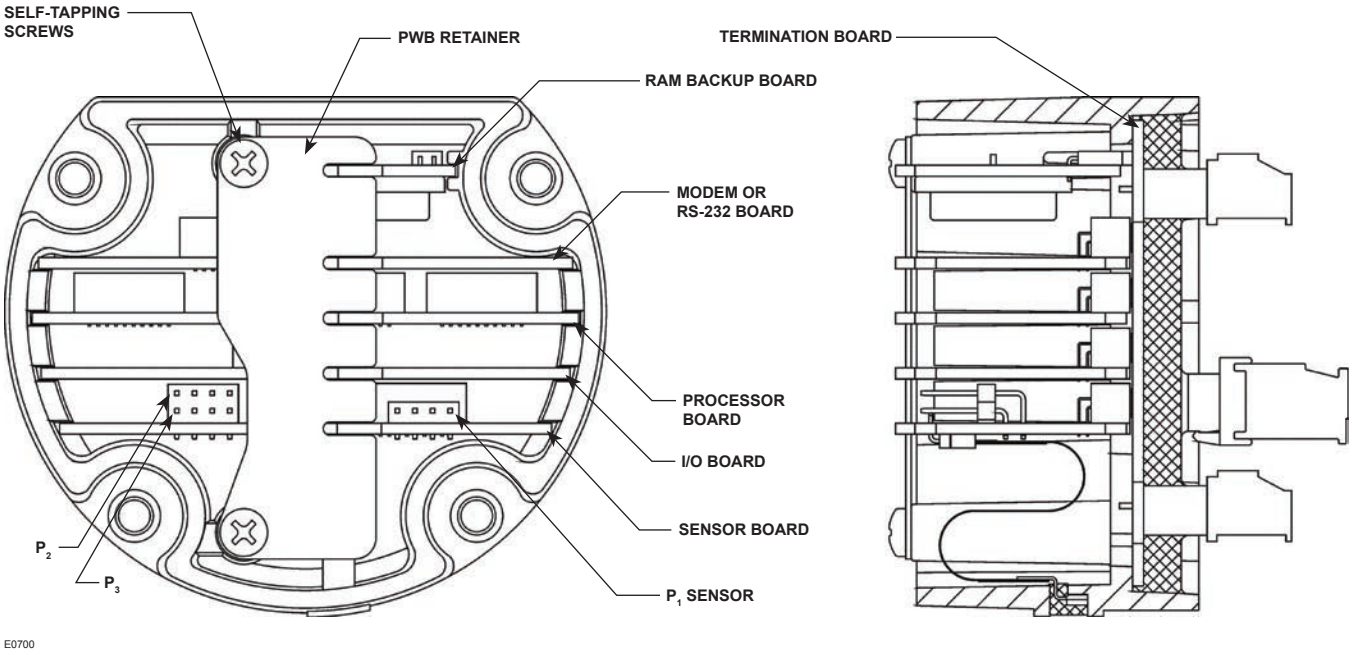


Figure 31. *Electronic Components Board Layout*

RS-232 Comm Board (Optional) (figure 28)—The RS-232 communications board provides an additional serial interface for the Type RF100 products and is designated COM2.

Modem Board (Optional) (figure 29)—The modem board is a state of the art 2400-baud modem with capacitive isolation and onboard DAA interface. The modem interfaces to the processor board and utilizes a standard Hayes protocol command set for modem configuration and dialing commands.

I/O Board (Optional)—This board provides additional I/O for the Type RF100 products. The I/O Board can be configured in one of the following ways:

- 1-AO, 1-AI, 2-DI, 1-DO
- 1-AO, 1-AI, 1-DI, 2-DO
- 2-AI, 2-DI, 1-DO
- 2-AI, 1-DI, 2-DO

Changes can be made in the field to switch to a different configuration. Two of the five channels are selectable (refer to figure 30). Switches labeled S1, S2, and S3 are provided. Switch S3 will select whether pin 6 is a DI or DO. Switch S1 will select whether pin 4 is an AO or AI. If pin 4 is selected as an AO, switch S2 will select whether it is a voltage (0 to 2V) or current (4 to 20 mA) output.

Parts Ordering

When corresponding with your Fisher Sales Office or Sales Representative about this equipment, reference the equipment serial number or FS number found on a nameplate. When ordering parts, reference the eleven digit part number of each part as found in the parts list.

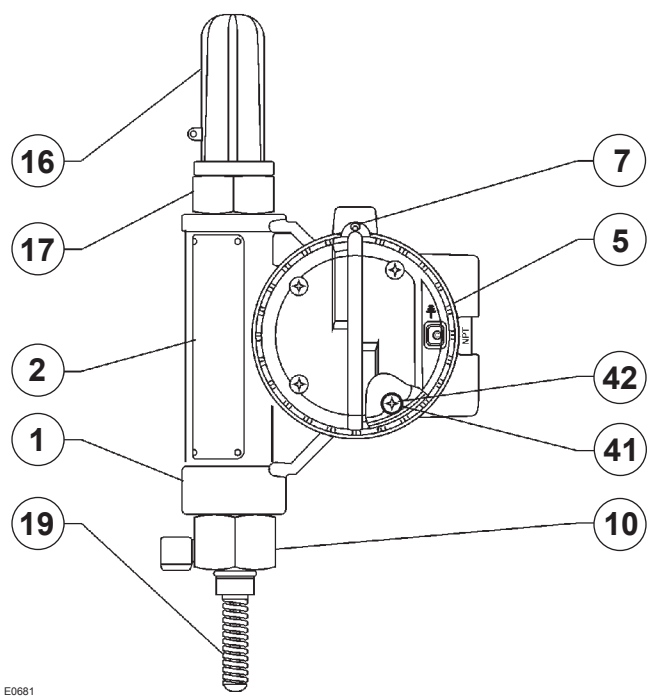
Parts List

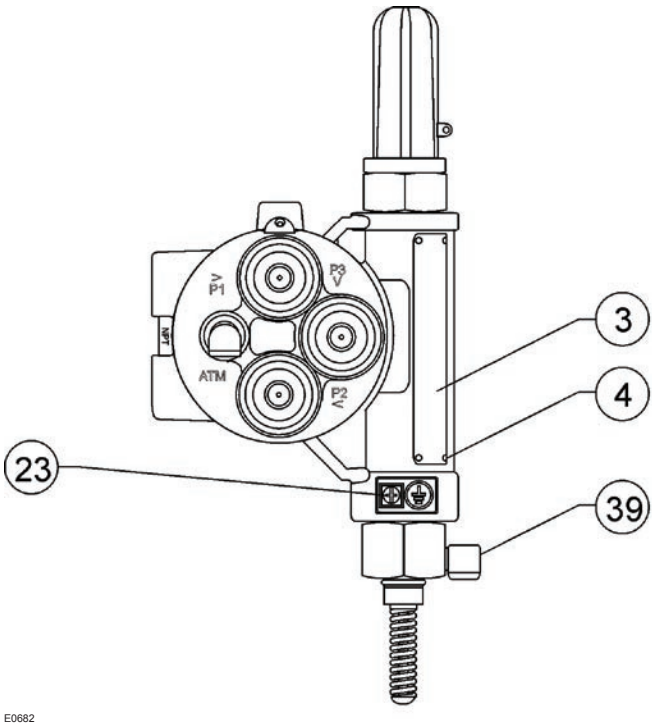
Types EZR and RF110 (figures 32 and 34)

Key	Description	Part Number
1	Housing Assembly	29B1935X012
2	Warning Label	- - - - - - - - - -
3	Nameplate	- - - - - - - - - -
4	Drive Screw (8 required)	1E953028982
5	Cover	38A5251X032
6	Cover O-Ring	T1205106562
7	Hex Socket Set Screw	18B5516X012
9	Stem	
	1 or 2-inch (DN 25 or 50) main valve body	T14337T0012
	3 or 4-inch (DN 80 or 100) main valve body	T14338T0012
	6-inch (DN 150) main valve body	T14339T0012
10	Mounting Adaptor	
	1 or 2-inch (DN 25 or 50) main valve body	39B1955X012
	3 or 4-inch (DN 80 or 100) main valve body	39B1956X012
	6-inch (DN 150) main valve body	T40633T0012
11	Upper O-Ring Retainer	
	1 or 2-inch (DN 25 or 50) main valve body	29B1964X012
	3 or 4-inch (DN 80 or 100) main valve body	29B1951X012
	6-inch (DN 150) main valve body	29B1951X012
12	Backup Ring (4 required)	
	1 or 2-inch (DN 25 or 50) main valve body	1N659106242
	3 or 4-inch (DN 80 or 100) main valve body	1J418806992
	6-inch main (DN 150) valve body	1J418806992
13	Upper Spring Seat	
	1 or 2-inch (DN 25 or 50) main valve body	18B2129X012
	3 or 4-inch (DN 80 or 100) main valve body	18B5968X012
	6-inch (DN 150) main valve body	29B0764X012
14	Indicator Washer	
	1 or 2-inch (DN 25 or 50) main valve body	18B2138X012
	3, 4, or 6-inch (DN 80, 100, or 150) main valve body	18B8503X012
15	Indicator Cover (with indicator)	
	1 or 2-inch (DN 25 or 50) main valve body	T14188T0012
	3 or 4-inch (DN 80 or 100) main valve body	19B2270X012
	6-inch (DN 150) main valve body	19B4691X012
16	Indicator Protector (with indicator)	
	1 or 2-inch (DN 25 or 50) main valve body	24B1301X012
	3, 4, or 6-inch (DN 80, 100, or 150) main valve body	29B2269X012
17	Indicator Housing	39B1960X012
18	Indicator Stem (with indicator)	
	1 or 2-inch (DN 25 or 50) main valve body	19B1978X012
	3 or 4-inch (DN 80 or 100) main valve body	19B1402X012
	6-inch (DN 150) main valve body	19B1402X012
19	Spring	
	1-inch (DN 25) main valve body	
	White	19B2399X012
	Light Blue	19B2400X012
	Black	19B2401X012
	2-inch (DN 50) main valve body	
	Green	18B2126X012
	Red	18B5955X012
	Yellow	19B0951X012
	3-inch (DN 80) main valve body	
	Yellow	T14184T0012
	Light Blue	19B0781X012
	Black	19B0782X012
	4-inch (DN 100) main valve body	
	Green	18B8501X012
	Red	18B8502X012
	6-inch main (DN 150) valve body	
	Yellow	19B0364X012
	Green	19B0366X012
	Black	19B0365X012
20	Jam Nut (4 required) (with indicator)	
	1 or 2-inch (DN 25 or 50) main valve body	60000410X12
	3, 4, or 6-inch (DN 80, 100, or 150) main valve body	1L286338992
21	Shuttle Cap, without Indicator	29B1954X012
22	Wire Retainer	14B3147X022
23	Wire Retainer	17B7757X022
24	Magnet Shuttle Assembly	
	1 or 2-inch (DN 25 or 50) main valve body	19B1963X012
	3 or 4-inch (DN 80 or 100) main valve body	19B1963X022
	6-inch (DN 150) main valve body	19B1963X032
25	PWB Cup Assembly	
	Type RF100	29B1041X032
	Type RF110	29B1041X022
26	Pressure Sensor Assembly	
	Inlet, Outlet, and Auxiliary Pressure Sensors	
	0 to 30-inches w.c. (0 to 75 mbar)	W30339X0012
	0 to 15 psig (0 to 1,03 bar)	39B1973X012
	0 to 35 psig (0 to 2,41 bar)	39B1973X062
	0 to 100 psig (0 to 6,90 bar)	39B1973X022
	0 to 300 psig (0 to 20,7 bar)	39B1973X032
	0 to 500 psig (0 to 34,5 bar)	39B1973X042
	0 to 1000 psig (0 to 68,9 bar)	39B1973X052
26	Pressure Sensor Plug	
	Used in place of pressure sensor assembly	29B1397X012
28	O-Ring	
	1 or 2-inch (DN 25 or 50) main valve body	
	Nitrile (NBR)	18B3438X012
	Fluoroelastomer (FKM)	1N430306382
	3 or 4-inch (DN 80 or 100) main valve body	
	Nitrile (NBR)	10A8931X012
	Fluoroelastomer (FKM)	10A8931X052
	6-inch (DN 150) main valve body	
	Nitrile (NBR)	10A3800X012
	Fluoroelastomer (FKM)	1R727606382
31	Pressure Sensor O-Ring	1N955306562
33	Shuttle Sleeve O-Ring (2 required)	1D2620X0072
34	Shuttle Sleeve	29B1965X012
36	O-Ring (2 required)	
	1 or 2-inch (DN 25 or 50) main valve body	
	Nitrile (NBR)	1H2926X0032
	Fluoroelastomer (FKM)	1H2926X0022
	3 or 4-inch (DN 80 or 100) main valve body	
	Nitrile (NBR)	1D191706992
	Fluoroelastomer (FKM)	1N423906382
	6-inch (DN 150) main valve body	
	Nitrile (NBR)	1D191706992
	Fluoroelastomer (FKM)	1N423906382
37	Battery Module	W38230X0012
38	Communication Card	
	RS-232	W38174X0012
	Dial Up Modem	W38223X0012
39	Vent (2 required)	27A5516X012
40	Pipe Plug, 1/4-inch NPT	1C3335X0012
41	Pan Head Machine Screw (4 required)	19B1398X012
42	Lock Washer (4 required)	19B1399X012
43	Cup Gasket	39B1940X012
44	Pipe Plug, 1/2-inch NPT (2 required)	1H5137X0022
45	Protective Cap (not shown)	
	1 or 2-inch (DN 25 or 50)	29B1418X012
	3 or 4-inch (DN 80 or 100)	29B1437X012
	6-inch (DN 150)	T21123T0012
52	Termination Label	29B1406X012
54	Interface Cable (not shown)	19B1434X012
	Serial Cable (not shown)	19B1435X012
66	Indicator Cap	
	1 or 2-inch (DN 25 or 50) main valve body	T14423T0012
	3, 4, or 6-inch (DN 80, 100, or 150) main valve body	T14424T0012
67	Input/Output Board	W38164X0012

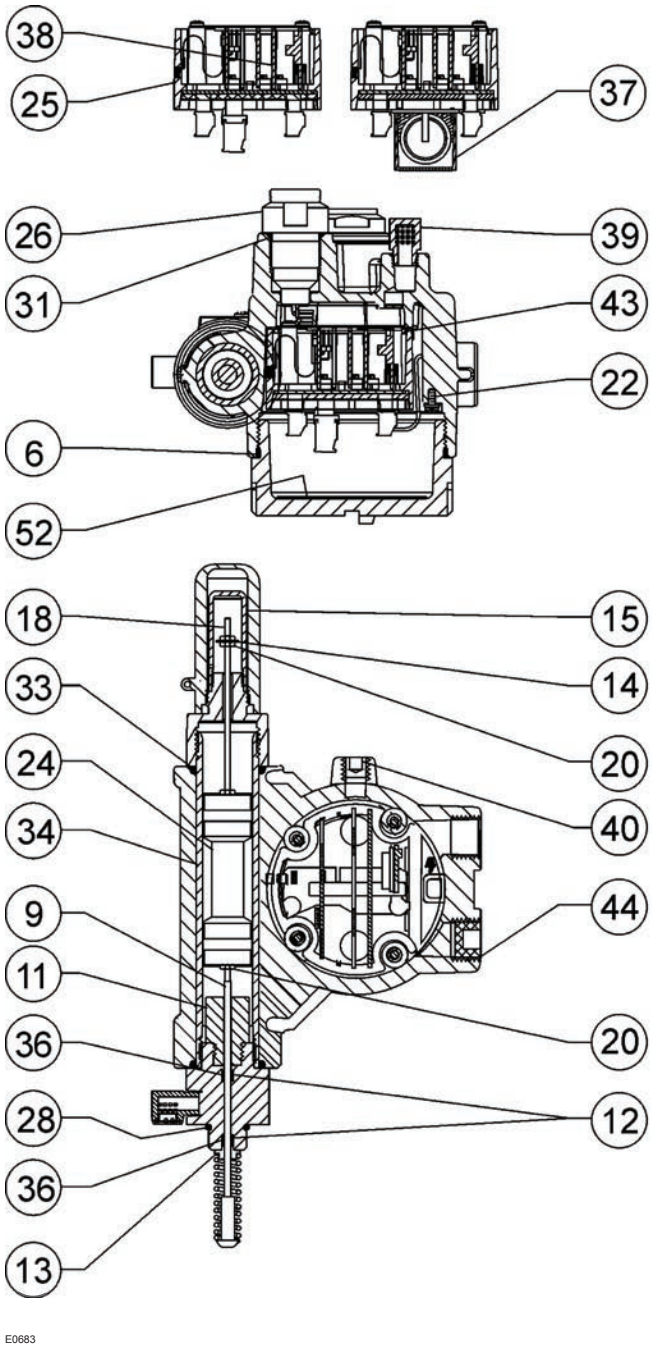
Type 1098-EGR (figure 33)

Key	Description	Part Number
1	Housing Assembly	29B1935X012
2	Warning Label	- - - - - - - - - -
3	Nameplate	- - - - - - - - - -
4	Drive Screw (8 required)	1E953028982
5	Cover	38A5251X032
6	Cover O-Ring	T1205106562
7	Hex Socket Set Screw	18B5516X012
8	Lower Indicator Fitting	
	1-inch (DN 25) main valve body	T21117T0012
	2, 3, and 4-inch (DN 50, 80, and 100) main valve body	T21107T0012
	6-inch (DN 150) main valve body	T21120T0012
9	Stem Assembly	
	Use with full capacity trim	
	1-inch (DN 25) main valve body	T21170T0012
	2-inch (DN 50) main valve body	T21170T0022
	3-inch (DN 80) main valve body	T21170T0032
	4-inch (DN 100) main valve body	T21170T0042
	6-inch (DN 150) main valve body	T21170T0062
	Use with restricted trim	
	2-inch (DN 50) main valve body	T21171T0022
	3-inch (DN 80) main valve body	T21171T0032
	4-inch (DN 100) main valve body	T21171T0042
	6-inch (DN 150) main valve body	T21171T0062
10	Mounting Adaptor	T40630T0012
12	Backup Ring (4 required)	1K786806992
14	Indicator Washer	18B8503X012
15	Indicator Cover	
	1-inch (DN 25) main valve body	14A6759X012
	2-inch (DN 50) main valve body	14A5678X012
	3-inch (DN 80) main valve body	14A5662X012
	4-inch (DN 100) main valve body	14A5647X012
	6-inch (DN 150) main valve body	14A5647X012
16	Indicator Protector	
	1 or 2-inch (DN 25 or 50) main valve body	24B1301X012
	3, 4, or 6-inch (DN 80, 100, or 150) main valve body	29B2269X012
17	Indicator Housing	39B1960X012
18	Indicator Stem	
	1-inch (DN 25) main valve body	T21152T0012
	2-inch (DN 50) main valve body	T21153T0012
	3-inch (DN 80) main valve body	T21155T0012
	4-inch (DN 100) main valve body	T21156T0012
	6-inch (DN 150) main valve body	T21156T0012
19	Spring	
	1-inch (DN 25) main valve body	
	0 to 60 psig (0 to 4,14 bar)	14A9687X012
	60 to 125 psig (4,14 to 8,62 bar)	14A9680X012
	125 to 400 psig (8,62 to 27,6 bar)	14A9679X012
	2-inch (DN 50) main valve body	
	0 to 20 psig (0 to 1,38 bar)	14A6768X012
	0 to 60 psig (0 to 4,14 bar)	14A6626X012
	60 to 125 psig (4,14 to 8,62 bar)	14A6627X012
	125 to 400 psig (8,62 to 27,6 bar)	14A6628X012
	3-inch (DN 80) main valve body	
	0 to 20 psig (0 to 1,38 bar)	14A6771X012
	0 to 60 psig (0 to 4,14 bar)	14A6629X012
	60 to 125 psig (4,14 to 8,62 bar)	14A6630X012
	125 to 400 psig (8,62 to 27,6 bar)	14A6631X012
	4-inch (DN 100) main valve body	
	0 to 20 psig (0 to 1,38 bar)	14A6770X012
	0 to 60 psig (0 to 4,14 bar)	14A6632X012
	60 to 125 psig (4,14 to 8,62 bar)	14A6633X012
	125 to 400 psig (8,62 to 27,6 bar)	14A6634X012
	6-inch (DN 150) main valve body	
	0 to 20 psig (0 to 1,38 bar)	15A2253X012
	0 to 60 psig (0 to 4,14 bar)	14A9686X012
	60 to 125 psig (4,14 to 8,62 bar)	14A9685X012
	125 to 400 psig (8,62 to 27,6 bar)	15A2615X012
21	Shuttle Cap (not shown)	29B1954X012
22	Wire Retainer	14B3147X022
23	Wire Retainer	17B7757X022
24	Magnet Shuttle Assembly	19B1963X042
25	PWB Cup Assembly	
	Type RF100	29B1041X032
	Type RF110	29B1041X022
26	Pressure Sensor Assembly	
	Inlet, Outlet, and Auxiliary Pressure Sensors	
	0 to 30-inches w.c. (0 to 75 mbar)	W30339X0012
	0 to 15 psig (0 to 1,03 bar)	39B1973X012
	0 to 35 psig (0 to 2,41 bar)	39B1973X062
	0 to 100 psig (0 to 6,90 bar)	39B1973X022
	0 to 300 psig (0 to 20,7 bar)	39B1973X032
	0 to 500 psig (0 to 34,5 bar)	39B1973X042
	0 to 1000 psig (0 to 68,9 bar)	39B1973X052
26	Pressure Sensor Plug	
	Used in place of pressure sensor assembly	29B1397X012
27	Stem O-Ring (2 required)	
	Nitrile	1E472706992
	Fluoroelastomer	1N430406382
30	Mounting Adaptor O-Ring	
	Nitrile	18B3438X012
	Fluoroelastomer	1N430306382
31	Pressure Sensor O-Ring	1N955306562
33	O-Ring (2 required)	1D2620X0072
34	Shuttle Sleeve	29B1965X012
35	Fitting O-Ring	
	1-inch (DN 25) main valve body	
	Nitrile	10A8931X012
	Fluoroelastomer	10A0811X012
	2, 3, or 4-inch (DN 50, 80, or 100) main valve body	
	Nitrile	10A3800X012
	Fluoroelastomer	1R727606382
	6-inch (DN 150) main valve body	
	Nitrile	1F262906992
	Fluoroelastomer	1F2629X0012
37	Battery Module	W38230X0012
38	Communication Card	
	RS-232	W38174X0012
	Dial Up Modem	W38223X0012
39	Vent	
	1-inch (DN 25) main valve body (2 required)	27A5516X012
	2, 3, 4, or 6-inch (DN 50, 80, 100, or 150) main valve body	27A5516X012
	(requires both part numbers)	T14340T0012
40	Pipe Plug, 1/4-inch NPT	1C3335X0012
41	Pan Head Machine Screw (4 required)	19B1398X012
42	Lock Washer (4 required)	19B1399X012
43	Cup Gasket	39B1940X012
44	Pipe Plug, 1/2-inch NPT (2 required)	1H5137X0022
52	Termination Label	29B1406X012
58	Interface Cable (not shown)	19B1434X012
59	Upper O-Ring Retainer	
	1-inch (DN 25) main valve body	T14330T0012
	2-inch (DN 50) main valve body	T21119T0012
	3-inch (DN 80) main valve body	T14329T0012
	4-inch (DN 100) main valve body	T21116T0012
	6-inch (DN 150) main valve body	T21116T0012
60	Lower O-ring Retainer	T14276T0012
61	Jam Nut (2 required)	14A5693X022
62	Locknut	T21159T0012
63	Upper Hex Nut (2 required)	1L286338992
64	Travel Stop (not shown)	
	2-inch (DN 50) main valve body	
	70% Capacity	14A9676X012
	30% Capacity	14A9677X012
	3-inch (DN 80) main valve body	
	40% Capacity	14A9671X012
	4-inch (DN 100) main valve body	
	40% Capacity	14A9670X012
	6-inch (DN 150) main valve body	
	40% Capacity	14A9682X012
66	Indicator Cap	T14424T0012
67	Input/Output Board	W38164X0012



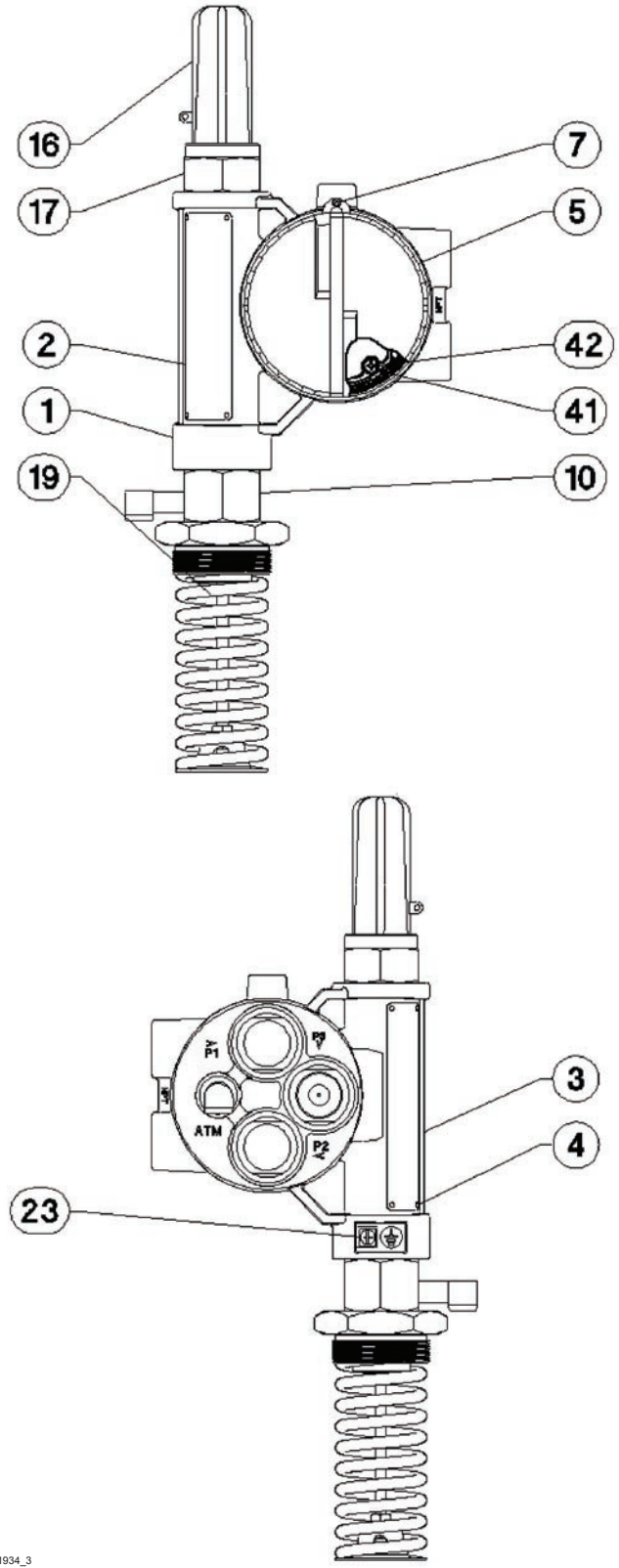


TYPE RF100 EXTERNAL PARTS ASSEMBLY FOR TYPE EZR

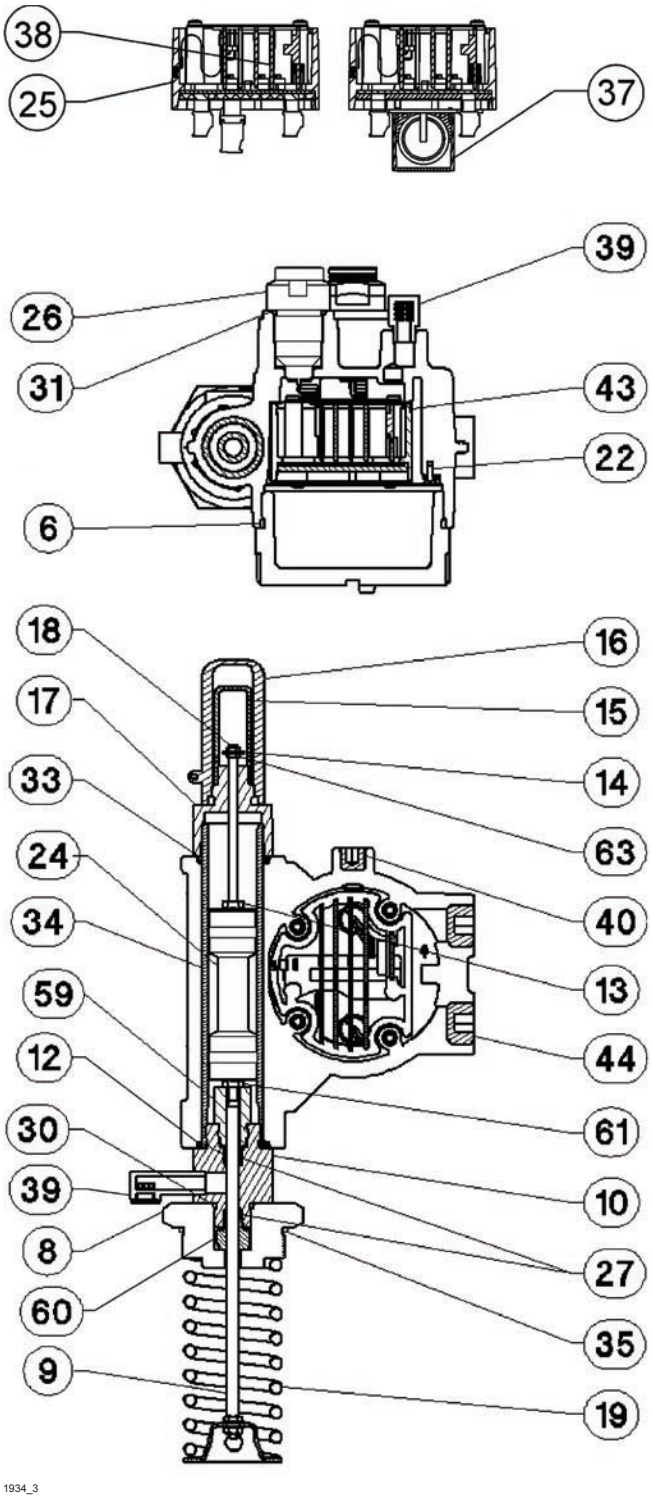


TYPE RF100 INTERNAL PARTS ASSEMBLY FOR TYPE EZR

Figure 32. *Type RF100 Parts Assembly for Type EZR*

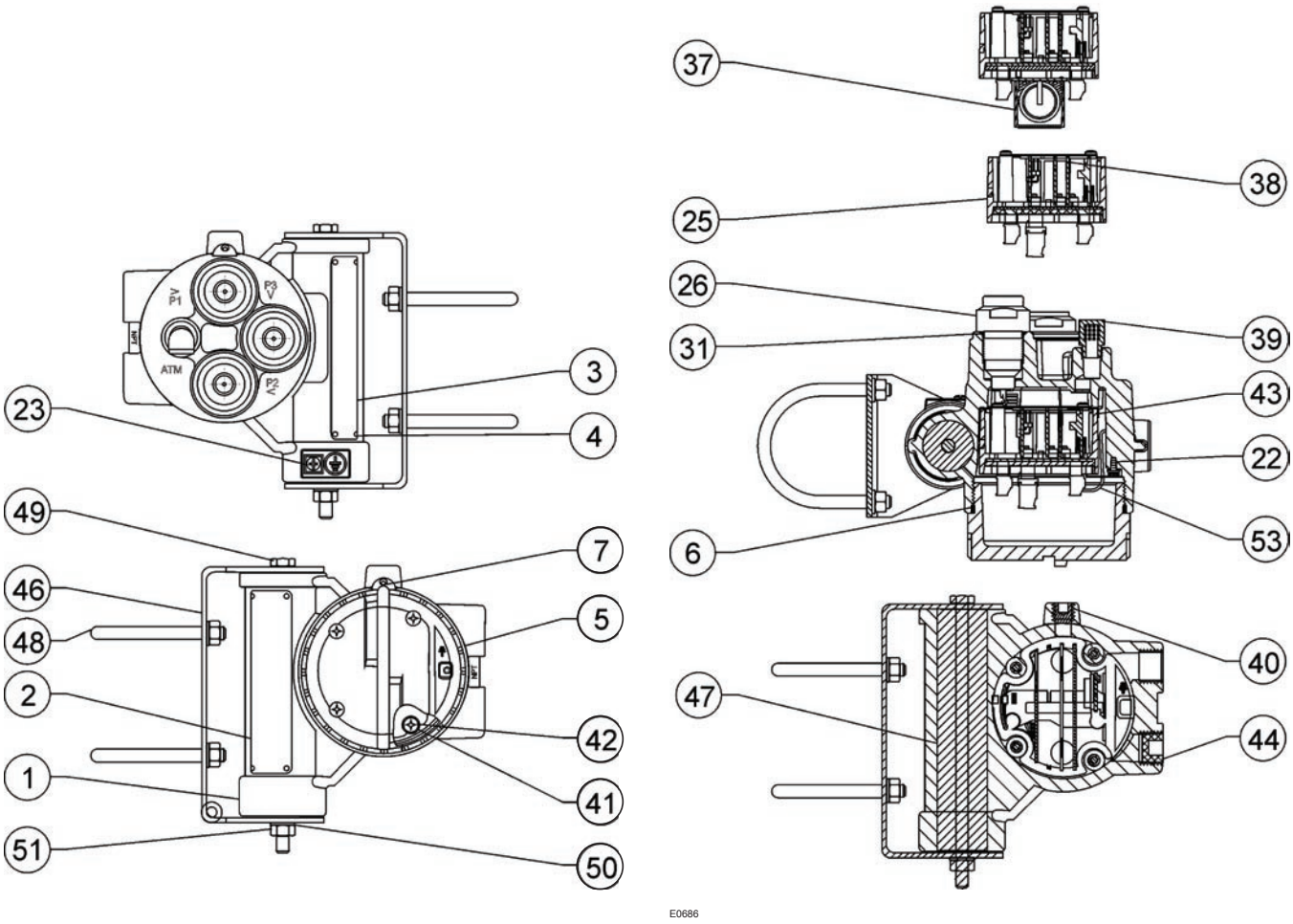


TYPE RF100 EXTERNAL PARTS ASSEMBLY FOR TYPE 1098-EGR



TYPE RF100 INTERNAL PARTS ASSEMBLY FOR TYPE 1098-EGR

Figure 33. *Type RF100 Parts Assembly for Type 1098-EGR*



TYPE RF110 EXTERNAL PARTS ASSEMBLY

TYPE RF110 INTERNAL PARTS ASSEMBLY

Figure 34. *Type RF110 Parts Assembly*

Type RF110 Mounting Parts (figure 34)

Key	Description	Part Number
46	Bracket	39B1421X012
47	Spacer	19B1420X012
48	U-Bolt (2 required)	19B1433X012
49	Carriage Bolt	19B1422X012
50	Lock Washer (5 required)	1C225728982
51	Nut (5 required)	1A352724122

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